

Techalloy

Company, Inc.

US EPA RECORDS CENTER REGION 5



1000376

RCRA Facility Investigation Draft Work Plan

***Techalloy Company, Inc.
Union, Illinois***

MARCH 1994



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- C Site Background
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- G Health and Safety Plan Agreement Form
- H HNu/OVA/HCN Operation, Maintenance, and Calibration Procedures

SECTION 1

INTRODUCTION

1.1 PURPOSE

This Work Plan has been prepared in response to an Administrative Order on Consent (Consent Order [AOC]) issued by the United States Environmental Protection Agency (U.S. EPA) to Techalloy Company Inc. (Techalloy), Union, Illinois (U.S. EPA I.D. No. ILD 005 178 975). The Consent Order was signed by U.S. EPA and Techalloy on 27 January 1993. This document has been prepared in accordance with the purpose statement and incorporates all of the information required by Section VI.C and Attachment I, Task I through Task III, of the order. The Consent Order requires that Techalloy initiate a RCRA Facility Investigation/Corrective Measures Study (RFI/CMS) under Section 3008(h) of the Resource Conservation and Recovery Act. The objectives as stated in the order (AOC, III, Statement of Purpose) are:

- "Perform a RCRA Facility Investigation to determine fully the nature and extent of any release of hazardous wastes and hazardous constituents from the facility."
- "Perform a Corrective Measures Study (CMS) to identify and evaluate alternatives for the corrective action necessary to prevent or mitigate any migration or release of hazardous wastes or hazardous constituents from or at the facility."
- "Perform Interim Measures (IM) at the facility if current or potential threats to human health or welfare or the environment are identified."

Techalloy has retained Roy F. Weston, Inc. (WESTON®) of Vernon Hills, Illinois, as its environmental consultant for this activity. Techalloy and WESTON will perform field investigations, data analysis, data evaluation, report preparation, implementation of interim measures, and evaluation of corrective measures.

1.2 ORGANIZATION OF THIS WORK PLAN

This work plan is intended to satisfy the Consent Order's requirements for information regarding facility background and known contamination, a pre-investigation evaluation of remedial alternatives, and a RFI/CMS work plan.

The Quality Assurance Project Plan has been prepared as a standalone document. This work plan is presented in the following eight sections:

- Introduction
- Facility Background Report
- Implementation of Interim Measures
- Pre-Investigation Evaluation of Corrective Measures
- Project Management Plan
- Data Management Plan
- Health and Safety Plan
- Community Relations Plan

SECTION 2

FACILITY BACKGROUND REPORT

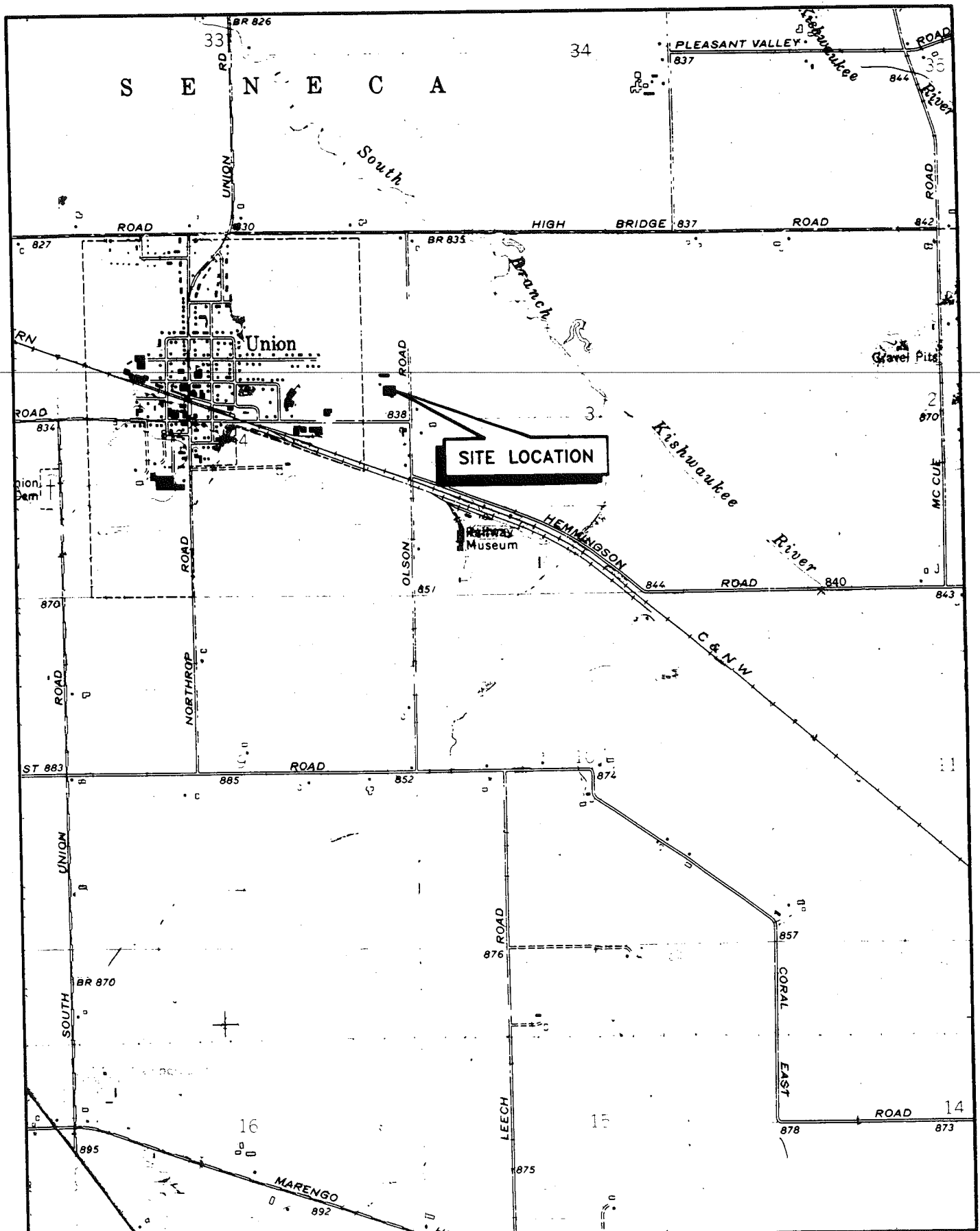
2.1 DESCRIPTION OF THE FACILITY

Techalloy Company, Inc. (Techalloy) is located at the intersection of Olson and Jefferson Roads in the Village of Union, McHenry County, Illinois. The Techalloy facility is located in the SE ¼, SE ¼, NW ¼, of Section 4, Township 43 North, Range 6 East (Figure 2-1). The developed portion of the facility occupies 5 acres. The Techalloy facility includes an additional 29 acres of agricultural land surrounding the facility (Figure 2-2).

2.2 ENVIRONMENTAL SETTING

2.2.1 Topography and Drainage

The Techalloy facility is located in southwest McHenry County in the Wheaton Morainal Country of the Great Lake Section of the Central Lowland Province. The Wheaton Morainal Country is characterized by complex morainal topography with greater relief and a more complicated slope pattern than most of northeastern Illinois. Irregularly shaped hills, mounds, and ridges are intermingled with basins, marshes and occasional lakes. The drainage pattern is geologically young and incomplete. Within this hilly morainal area, there are sizable level to gently sloping outwash plains. The Techalloy facility is situated on the southern fringe of an outwash plain. The outwash plain is dissected by the South Branch of the Kishwaukee River, which flows from the southeast to the northwest and lies approximately 1/2 mile northeast of the site. The western portion of McHenry County is drained by the Kishwaukee River and its tributaries. Drainage is westward to the Rock River.

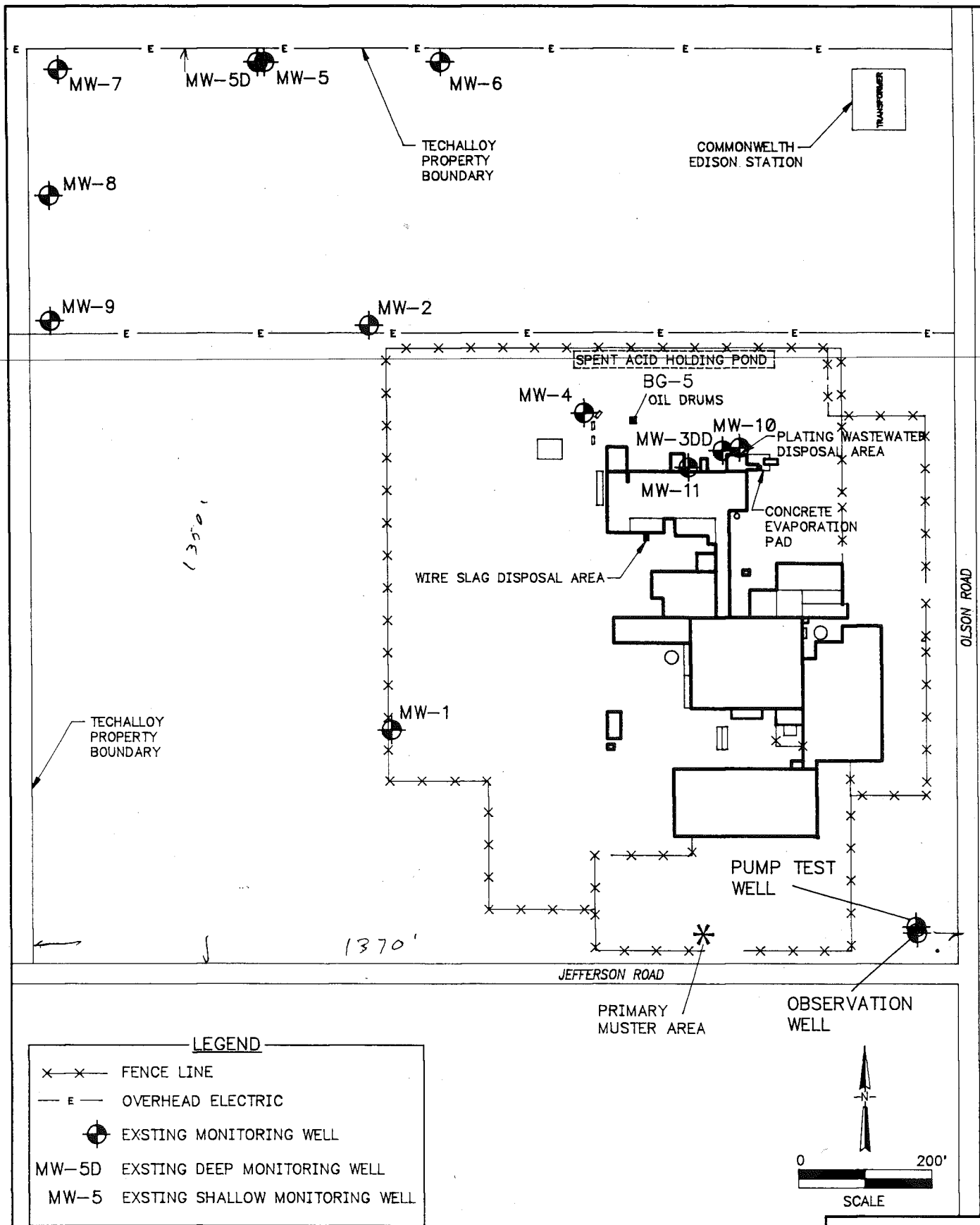


Three Hawthorn Parkway
Vernon Hills, Illinois
60061

FIGURE
2-1

SITE LOCATION
TECHALLOY COMPANY, INC.
Union, Illinois

REV.



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Three Hawthorn Parkway
Vernon Hills, Illinois
60061

FACILITY FEATURE MAP
TECHALLOY COMPANY, INC.
Union, Illinois

2.2.2 Climate

McHenry County has a continental climate typical of the north central United States. This climate includes a wide range in temperature between winter and summer and an irregularly distributed, but usually abundant rainfall. Temperature extremes range from approximately -27°F to 109°F. The mean annual temperature is 49°F. The average winter temperature is 22.5°F, and the average summer temperature is 70.6°F. The annual precipitation is approximately 32 inches. Average yearly evapotranspiration for the area is 26 to 27 inches. The prevalent wind direction is from the west, although monthly variations do occur. There are no topographical barriers to air flow near the Techalloy facility.

2.2.3 Demography and Land Use

The majority of the property surrounding the Techalloy facility is used for agriculture. The properties south, east, north and northwest of the site are farmland. These areas are sparsely populated with farm-related dwellings. A few small businesses are located southwest and west of the site along Jefferson Road, which runs along the south side of the facility. The eastern boundary of the Village of Union, Illinois, is situated approximately 125 feet west of the site.

2.2.4 Geology

Regional Geology

The surficial geology of McHenry County is composed of Wisconsinian stage glacial deposits. At least two, possibly three, glaciers advanced across the McHenry County area. The thickness of the drift left by the glaciers varies from about 50 to 400 feet, and is commonly more than 200 feet in the morainal areas that occupy the eastern four-fifths of the county (USDA, McHenry County Soils, Soil Report 81, 1965). The thick till deposits

occur as a series of morainal ridges and till plains interspersed with areas of outwash. The moraines and outwash plains were formed successively by retreating ice in an eastward direction. Composition of the moraines and outwash plains generally varies from clean gravel and sand, through the various loamy soils to silty clay and clay.

The first bedrock unit encountered in southwestern McHenry County is the Ordovician Age Maquoketa Formation (Willman, 1971). The Maquoketa Formation consists primarily of shales. The Maquoketa shale units are light gray to green, plastic to brittle, with some dolomite. The Maquoketa Formation is approximately 200 to 340 feet thick in this area. The Ordovician Age Glenwood St. Peter Formation underlies the Maquoketa shale. The Glenwood St. Peter Formation is a fine- to coarse-grained sandstone with minor amounts of shales. This unit is approximately 350 feet thick in this area. The Cambrian Age Ironton Galesville Formation underlies the Ordovician Formations. The Ironton Galesville is a fine- to medium-grained, well-sorted sandstone, approximately 600 feet thick in this area. The Cambrian Age Mt. Simon Formation is the next and deepest unit and overlies the Precambrian crystalline rock. The Mt. Simon is a coarse-grained sandstone with lenses of shale and siltstone. The Mt. Simon is approximately 2,000 feet thick.

Site Geology

The natural soil at and around the Techalloy facility is the Volinia silt loam. The Volinia is nearly level, well to very well drained, and approximately 3 feet thick. The Volinia is developed over loose sand and fine gravel deposits of outwash plains. The majority of the Techalloy main plant area has been covered with 1 to 2 feet of gravel fill.

Boring logs from past site drilling activities indicate the surficial materials overlie poorly sorted fine- to coarse-grained sand and gravel outwash deposits. On the north side of the

facility, the sand and gravel extends to 35 feet below ground surface (bgs). At the northwest property boundary, the sand and gravel unit extends to 85 feet bgs.

Underlying the sand and gravel is a silty clay till unit (Marengo Till). The till surface slopes to the northwest. The unit is approximately 80 feet thick at the facility and is underlain by the Maquoketa shale.

2.2.5 Hydrogeology

Regional Hydrogeology

Groundwater is obtained from four major aquifer systems in northeastern Illinois - glacial drift, shallow bedrock, and two divisions of the deep bedrock (Hughes et al., 1966).

The glacial drift aquifer system is restricted to the unconsolidated materials overlying the bedrock; more specifically, to the sand and gravel beds. The shallow bedrock aquifer system consists of those bedrock units that commonly directly underlie the glacial drift and are recharged locally by precipitation. The major units in the system are the Silurian age dolomite and the Maquoketa shale and dolomite. The Silurian age dolomite yields the most water and is present in the eastern half of McHenry County. The Maquoketa shale and dolomite underlies the Silurian dolomite in the eastern part of the county and directly underlies the glacial drift in the western portion of the county. The Maquoketa group separates the shallow bedrock aquifer system from the underlying deep bedrock aquifer systems. The shale beds of the Maquoketa group are relatively impermeable and where present (i.e., beneath the Techalloy facility), these beds act as a confining layer above the deep bedrock aquifer systems.

The two deep bedrock aquifer systems are the Cambrian-Ordovician and the deep Cambrian. The Cambrian-Ordovician is comprised of the Glenwood St. Peter and Ironton

Galesville sandstones. The deep Cambrian aquifer is the Mt. Simon sandstone, which overlies the Precambrian crystalline rock.

Site Hydrogeology

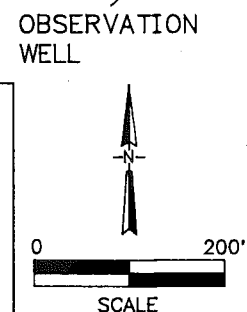
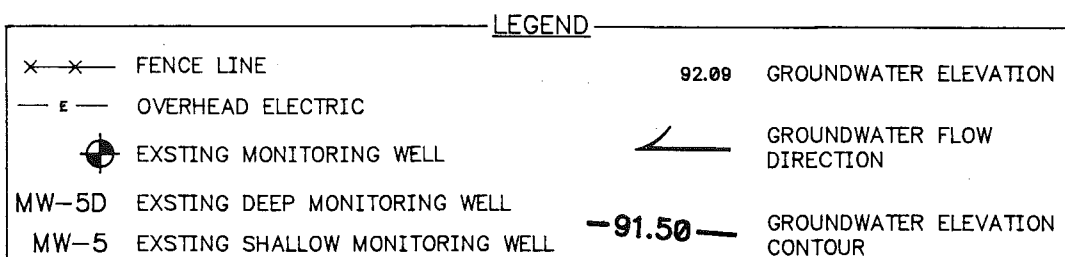
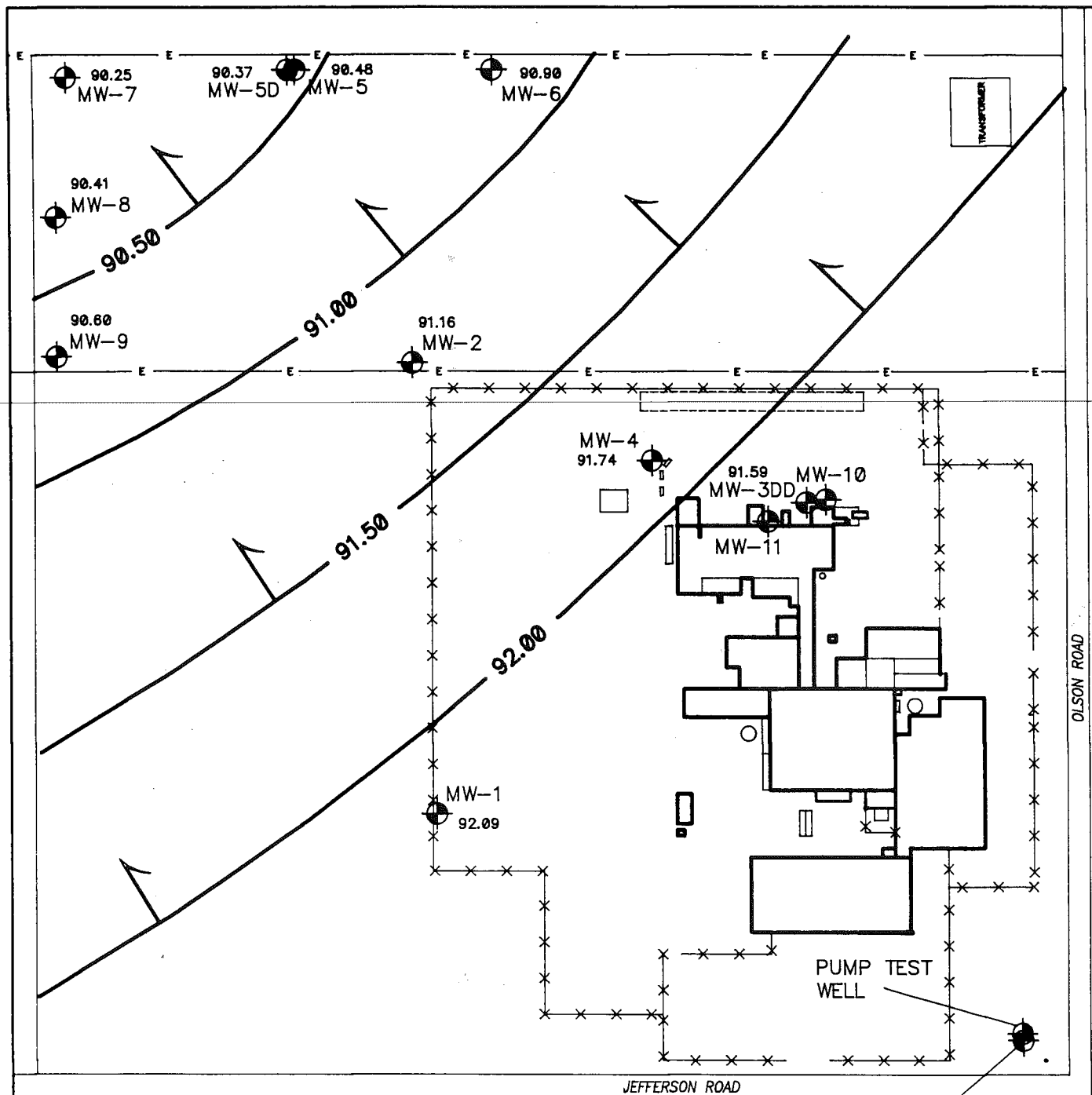
Previous studies at the Techalloy facility have determined that groundwater occurs approximately 9 feet bgs within the sand and gravel deposits. The sand and gravel unit is the underlying aquifer.

The sand and gravel unit extends from near ground surface to 35 feet bgs at the facility. At the northwest corner of the Techalloy property and beyond, the sand and gravel unit extends from near ground surface to 85 feet bgs. Immediately below the sand and gravel is the silty clay Marengo till. The upper boundary of the Marengo till constitutes the lower boundary of the sand and gravel aquifer. The Marengo till is approximately 80 feet thick in proximity to the facility and is underlain by the Maquoketa shale.

Groundwater within the sand and gravel flows northwestward (Figure 2-3). The hydraulic gradient between existing monitoring wells MW-1 and MW-9 has been measured at 2.3×10^{-3} ft/ft.

2.3 HISTORY OF OWNERSHIP AND OPERATIONS

Techalloy began operations at the Union, Illinois facility in 1960. Prior to 1960, the property was farmland. Since 1960, Techalloy has been operating as a specialty handler of stainless steel wire products. The end product is stainless steel wire coils of varying diameters and tensile strengths that are distributed with and without special coatings.



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FIGURE 2-3



Three Hawthorn Parkway
Vernon Hills, Illinois
60061

GROUNDWATER ELEVATION CONTOUR MAP
TECHALLOY COMPANY, INC.
Union, Illinois

2.3.1 Manufacturing Activities

The basic processing of the wire at the Techalloy facility begins with initial cleaning of the wire, if required, to remove oils. The cleaning process uses a caustic cleaning solution with a surfactant or acids to eliminate any scale or oxides that have formed on the stainless steel wire. The second step is to add a pre-coat product to the wire which, after application, provides a rough surface so that soap lubricant will be pulled onto the wire as it is being drawn through the dyes on the drawing machines. The pre-coat also serves to protect the wire so that it does not get scratched when it is pulled through the dyes.

After this process, the wire is sent back to the caustic bath to remove soaps and pre-coat prior to annealing. After annealing, the scale on the wire is removed by dipping the wire in ammonium bifluoride or potassium permanganate, followed by nitric acid, sodium hydroxide, then sulfuric acid. Another coating of pre-coat is then applied prior to being drawn in the high rate drawing machine. The wire is cleaned in an ultrasonic bath and then annealed further. The pre-coat is then removed in the caustic bath and the wire is sent to the straightening and cutting department or the shipping department.

A coating process is used for some wires to provide an additional lubricant for other processing. Typically this coating consists of a nickel chloride strike followed by a potassium copper cyanide or a copper cyanide dip to provide a very thin coating of copper, which serves as a lubricant for further processing.

Past manufacturing processes included the use of virgo salts for descaling instead of potassium permanganate. In this process, the wire was drawn through a molten bath of virgo salts to descale the wire. This process has been replaced by the ammonium bifluoride/potassium permanganate processes used today.

Prior to 1978, chlorinated solvents were used to clean wires. In 1978, the use of chlorinated solvents stopped, and the wires were cleaned in an ultrasonic water bath.

Another past process that was used at the Techalloy facility that has since been discontinued was the use of lead coating to provide lubrication prior to drawing through dyes. In the early existence of the Techalloy facility, lead coating was the only coating process known to act as an appropriate lubricant for drawing stainless steel wire through dyes. The process was very similar to the current processes, except lead was used instead of the pre-coat solution or the nickel and copper coating process. The lead-coated wires were subsequently treated with lime to provide the roughness needed to draw the soap into the dye. Beginning in 1960, wire was handled in this method. Techalloy changed over to the current processes in the 1970s.

From 1980 to 1988 the spent acids (pickle liquor) and rinse water from the pickling process were treated in-house at the acid treatment unit. The acid treatment unit was a batch neutralization and filtration system with the process code T01. Treatment was initiated after waste acid was diverted to the system and one of the two 1,000-gallon waste acid collection tanks became full. Neutralization was first achieved with the metered addition of caustic (sodium hydroxide or potassium hydroxide) until a near-neutral pH was reached. The neutralized acid was then conveyed to bag filters, and the filtrate was clarified and recycled to the acid rinse tanks on the production line.

2.3.2 Waste Generation and Disposal

This subsection provides a summary of the wastes generated and their associated disposal practices.

Spent acids (D002, D007) are generated from the pickling baths that remove scale from the wire. From 1960 to 1980, the spent acids were evaporated in the spent acid holding pond. From 1980 to 1988, the spent acids were treated at the in-house treatment facility. From 1988 to the present, the spent acids have been removed directly from the pickling tanks and transported to Clean Harbors of Chicago, Inc., Chicago, Illinois for treatment. The acids (nitric, sulfuric, hydrofluoric and muriatic) are generated at a rate of approximately 3,000 gallons one to three times per month.

The pickling rinse water (D002, D007) accumulates from rinsing the wire between acid baths. From 1960 to 1980, the rinse water was also evaporated in the spent acid holding pond. From 1980 to 1988, the water was treated at the in-house treatment facility. From 1988 to the present, the rinse water has been removed and transported to Clean Harbors of Chicago, Inc., for treatment. Approximately 5,000 gallons accumulates one to three times per month.

Plating wastewater was generated from the copper cyanide and nickel sulfate plating process. From 1968 to 1979, the plating wastewater was occasionally discharged at the northeast corner of the facility (PRC Consultants, Preliminary Assessment: Techalloy Illinois, Inc., 8 November 1991). From 1980 to 1988, the wastewater was treated at the in-house treatment facility. In 1988, the plating process was converted to a closed loop filter system. Expended plating filters accumulate from the replacement of the filters in the plating tanks. The filters are transported to Cyanokem, Inc. of Detroit, Michigan for treatment. The filters accumulate at a rate of 110 gallons per year.

Ammonium bifluoride (ADS) sludge accumulates in the rinsate tanks. The sludge has always been transported off site. Presently, the sludge is collected in drums and transported to Clean Harbors of Chicago, Inc. for treatment. The sludge accumulates at a rate of approximately 600 gallons every two months.

Nonhazardous sludge from a proprietary borate salt solution (SP-6) is accumulated from the cleaning of the lubricant tanks. The sludge has always been transported off-site. Presently, the sludge is shipped to Clean Harbors of Chicago, Inc., for treatment. The sludge accumulates at a rate of 165 gallons every two to three years.

Trichloroethane (1,1,1-TCA and 1,1,2-TCA) was used as wire degreaser from 1968 to 1978. During this time period, spent TCA was treated by evaporation on a concrete pad at the northeast corner of the facility. Since 1978, TCA has not been used at the facility.

A variety of waste oils is also generated on site. The oils have always been transported off site for disposal.

High viscosity waste oil is generated in the wire drawing process. The oil is transported to Clean Harbors of Braintree, Inc., Braintree, Massachusetts for incineration. The oil accumulates at a rate of 2,585 gallons per year.

Water soluble waste oil is accumulated from cooling the dyes in the machines. The oil is transported to Clean Harbors of Chicago, Inc. for treatment. The oil accumulates at a rate of approximately 275 gallons per year.

Crankcase oil from general vehicle and machinery maintenance is transported to American Chemical Services in Griffith, Indiana for treatment. The oil accumulates at a rate of 1,430 gallons per year.

2.3.3 Regulatory History

On 15 August 1980, Techalloy filed a Notification of Hazardous Waste Activity for the Hazardous Waste Treatment Facility and the Copper Cyanide Waste Destruction Unit,

designating the facility as a generator and treatment/storage/disposal (TSD) facility. Techalloy filed its Part A permit application on 11 November 1980, indicating that 800,000 pounds of K063 waste was generated per year (process code T01). Since that time, the following regulatory-associated activities have taken place:

- **21 April 1982.** IEPA determined that Techalloy lacked a written waste analysis plan and a written description of necessary training for facility personnel (PRC Consultants, Preliminary Assessment: Techalloy Illinois, Inc., 8 November 1991).
- **15 July 1985.** IEPA determined that Techalloy lacked a complete waste analysis plan a contingency plan and operating record, operator inspections, and training records. The Part A permit did not include all waste activity at the facility, and waste containers were not labeled. (Ibid.) According to U.S. EPA's contractor (PRC), all above waste issues were corrected by 14 February 1986. (Ibid.)
- **2 December 1985.** Permit and notification were revised to add F001 and D003 wastes (T01) and change the K063 waste to K062 waste (process codes S02, T01).
- **18 January 1988.** IEPA determined that Techalloy lacked a complete waste analysis plan and their Part A permit contained an improper process code. According to U.S. EPA's contractor, above issues were corrected by 27 May 1988. (Ibid.)
- **18 January 1988.** Notification and permit were resubmitted to add F006 and D002 wastes (T01) and change the process code on the D003 waste to T04.
- **22 March 1990.** IEPA determined Techalloy lacked written assessments of system integrity for the wastewater treatment and pickling rinse tanks, failed to accurately identify waste, and failed to properly label waste containers. (Ibid.) According to U.S. EPA's contractor, above issues were corrected by 30 May 1990. (Ibid.)
- **December 1990.** Added F008 waste and indicated production of 3,187,000 pounds of D002 waste per year (S02)..

- **In 1990**, WESTON, on behalf of Techalloy, submitted a RCRA closure plan to IEPA for the Copper Cyanide Waste Destruction Unit (cyanide tank), the Hazardous Wastewater Treatment Facility (Acid Treatment) unit, and the Acid Tank Room (acid pits or pickling house). Figure 2-4 illustrates these Solid Waste Management Units (SWMUs). IEPA approved the closure plan on 8 February 1991.
- At the present time, all three of these units are undergoing RCRA closure. The Copper Cyanide Waste Destruction Unit and the Hazardous Wastewater Treatment Facility are inactive and have been dismantled. The Acid Tank Room has been closed, retrofitted and remains active.

Techalloy has applied for a permit from IEPA for air pollution control equipment to govern emissions at 15 acid descaling tanks and seven annealing furnaces.

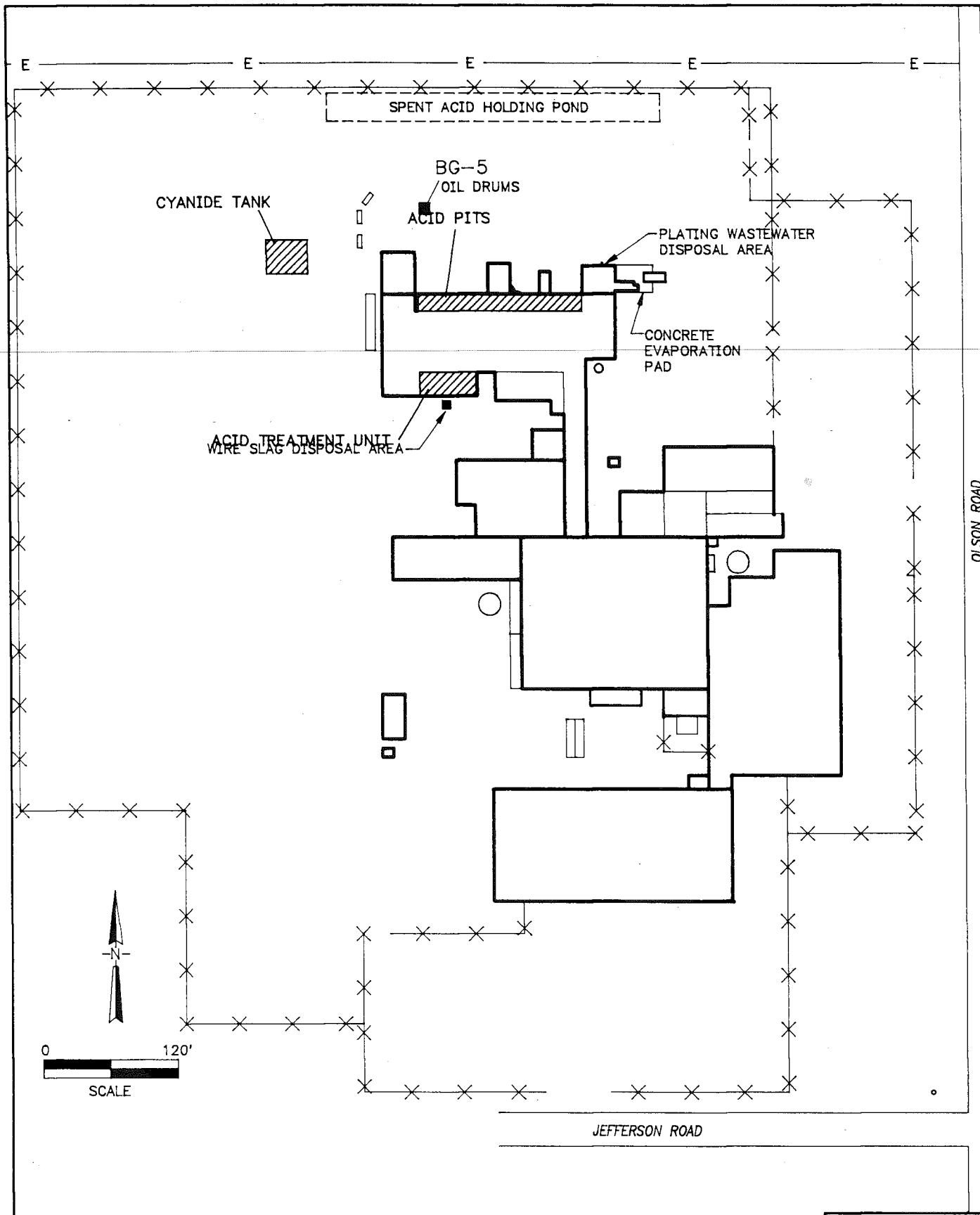
2.4 PREVIOUS SITE INVESTIGATIONS

2.4.1 Source Areas

Phase I Soil Investigation

The first investigation (Phase I investigation) took place in January 1990. U.S. Testing, Inc. conducted an environmental assessment and subcontracted Roy F. Weston, Inc. (WESTON®) to perform field activities. WESTON collected soil samples as part of a real estate transaction assessment.

A total of 10 soil borings (SB-05 through SB-14) were drilled in areas adjacent to the settling pond, the drum storage, the tank storage, the evaporation pad, and the wastewater discharge area. The soil sample locations are shown in Figure 2-5. Additionally, a soil sample, SS-01, was also collected from SB-12 soil boring location at a depth of 2 to 5 feet bgs.



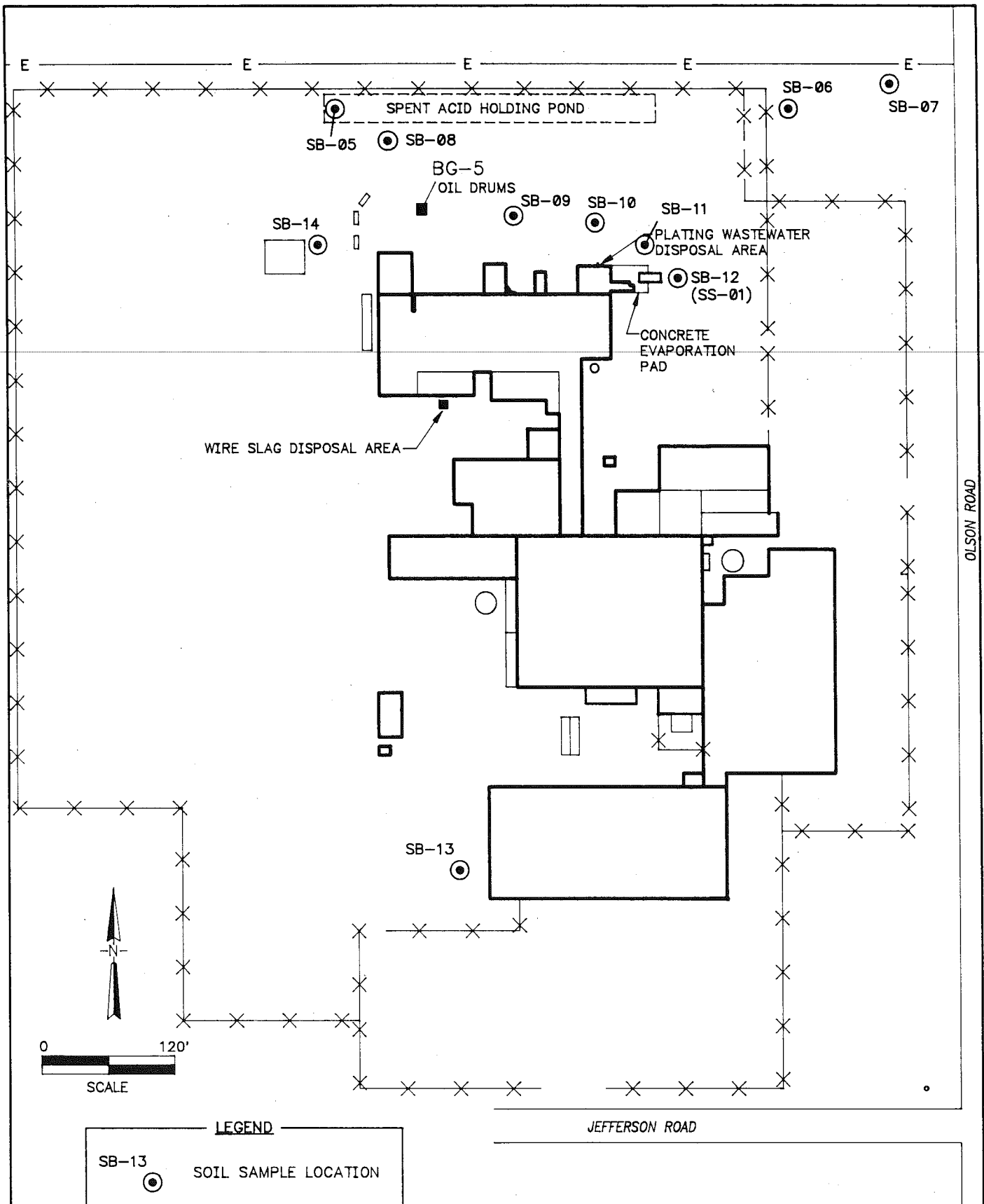
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FIGURE 2-4



Three Hawthorn Parkway
Vernon Hills, Illinois
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PREVIOUS RCRA FACILITY
CLOSURE PLAN SWMUs
TECHALLOY COMPANY, INC.
Union, Illinois



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FIGURE 2-5



Three Hawthorn Parkway
Vernon Hills, Illinois
60061

PHASE I SOIL SAMPLE LOCATIONS
TECHALLOY COMPANY, INC.
Union, Illinois

Soil samples SB-05 through SB-14 were analyzed for parameters listed in Table 2-1. The analytical results for samples SB-05 through SB-14 are also summarized in Table 2-1. Levels of chromium were detected in the soil sample from the settling pond area (SB-05). Levels of lead were detected in the soil sample from the evaporation pad area (SB-12). Petroleum hydrocarbons were detected above detection limits in the samples from the evaporation pad area (SB-12) and southwest corner of the building (SB-13).

Only one soil sample (SS-01) was analyzed for volatile organic compounds (VOCs). The VOC results are summarized in Table 2-2. Levels of chlorinated hydrocarbons were detected in this soil sample. The concentration of VOCs detected in this soil sample was 1,000 mg/kg (parts per million or ppm) of 1,1,1-trichloroethane (1,1,1-TCA).

Phase II Soil Investigation

In February 1991, WESTON began a Phase II soil investigation to further characterize the shallow subsurface soils at the Techalloy property and identify potential source areas of groundwater constituents. The samples depths, locations and rationale are presented in Table 2-3. In June 1991, WESTON submitted the "Phase II Soil and Groundwater Investigation" report to the Illinois Environmental Protection Agency (IEPA) (Appendix A).

During Phase II, WESTON collected a total of seven soil samples (SS-1 through SS-7) from areas adjacent to the acid treatment room, the heavy wire building, and the northeast portion of the Techalloy plant. The soil sample locations are shown in Figure 2-6. These areas were believed to be previous chemical spill or release areas. The sample depths, sample locations, and sample location rationale are summarized in Table 2-3.

Table 2-1
Phase I Soil Investigation Results (January 1990)
Techalloy Company, Inc.
Union, Illinois
(All Concentrations in mg/kg)

Parameter	SB-05	SB-06	SB-07	SB-08	SB-09	SB-10	SB-11	SB-12	SB-13	SB-14
Nitrate as N	ND	2.2	ND	29.6	34.6	8.2	NA	9.0	1.1	NA
pH, pH units	8.1	9.5	9.4	7.6	7.5	7.2	NA	7.4	8.6	NA
Petroleum hydrocarbons	ND	ND	ND	ND	ND	ND	NA	39.8	193	NA
Sulfate	115	106	ND	242	188	537	NA	331	126	NA
Arsenic, total	2.7	2.5	2.2	2.0	1.8	3.3	NA	ND	1.8	NA
Barium, total	7.3	12.2	7.5	12.7	11.0	83.6	NA	72.6	6.2	NA
Cadmium, total	3.5	2.8	3.7	ND	ND	ND	NA	ND	2.2	NA
Chromium, total	2,800	13.9	5.8	15.8	11.1	34.6	NA	13.7	5.8	NA
Mercury, total	ND	ND	0.15	ND	ND	ND	NA	0.27	ND	NA
Lead, total	ND	ND	ND	9.0	5.7	64.6	NA	427	4.7	NA
Selenium, total	ND	ND	ND	ND	ND	ND	NA	ND	ND	NA
Silver, total	ND	ND	ND	ND	ND	ND	NA	ND	ND	NA
Cyanide, total	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
Copper, total	NA	NA	NA	NA	NA	NA	4.5	NA	NA	6.6

ND - Nondetect.

NA - Not analyzed.

Table 2-2
Phase I Soil Investigation VOC Results (February 1991)
Techalloy Company, Inc.
Union, Illinois
(All Concentrations in $\mu\text{g}/\text{kg}$)

Volatile Organic Compounds (VOCs)	SS-01 (SB-12)
Methylene chloride	1,100 JB
Acetone	4,700 JB
1,1-Dichloroethene	19,000
1,1-Dichloroethane	6,200
2-Butanone	7,900 B
1,1,1-Trichloroethane	1,000,000
Trichloroethene	260,000
1,1,2-Trichloroethane	4,100
Tetrachloroethene	870,000
Toluene	12,000
Ethylbenzene	1,200 J
Xylene (total)	7,200

Note: Only VOCs detected above method detection limits are presented.

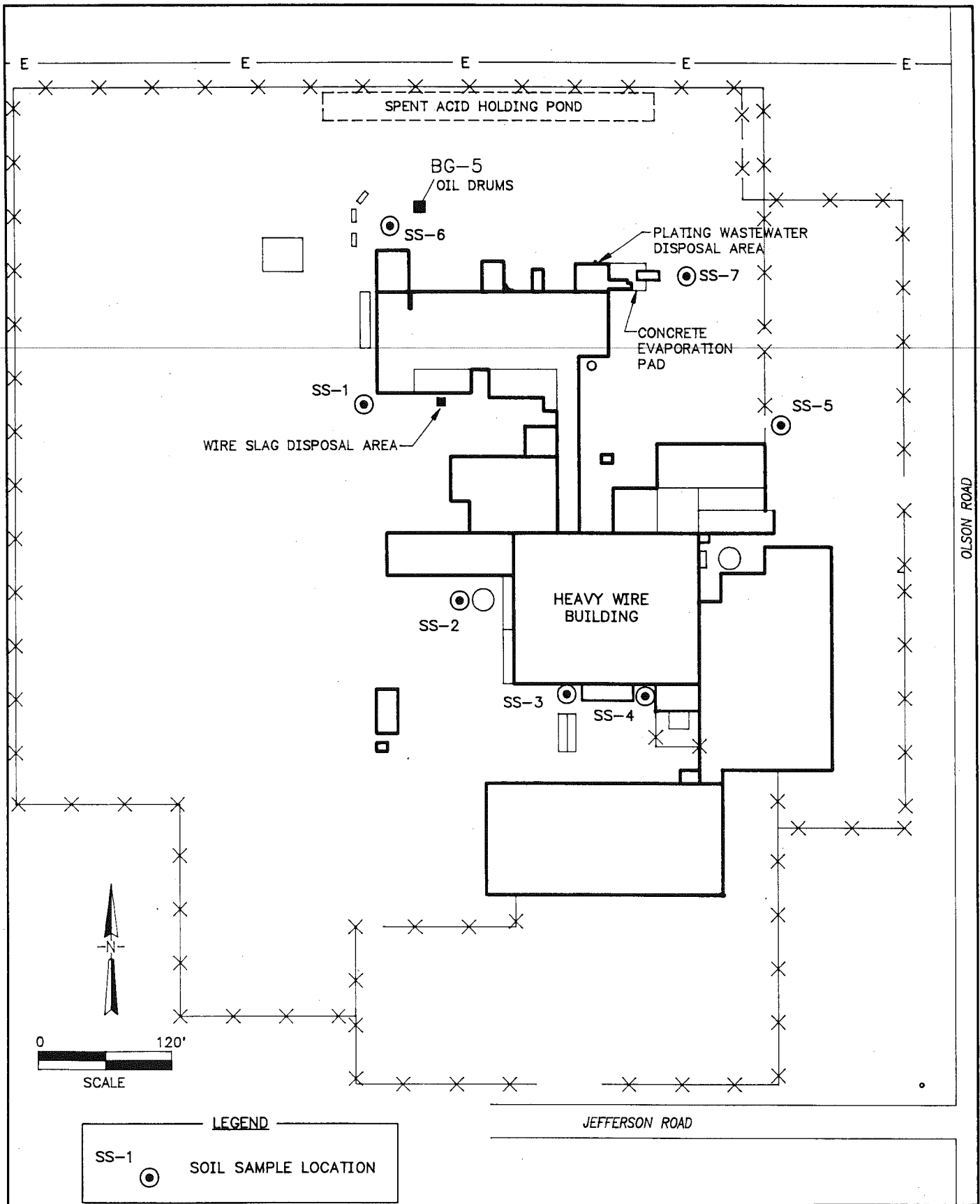
J - Indicates an estimated value.

B - Indicates that the compound was also found in blank.

Table 2-3

Phase II Soil Investigation - Sample Location/Rationale (February 1991)
Techalloy Company, Inc.
Union, Illinois

Sample Number	Depth (ft)	Sample Location	Sample Location Rationale
SS-1	3	Western edge of the concrete slab, south of the acid treatment room.	To determine the impact of any spill or release from the acid treatment room.
SS-2	6 (To compensate for 3 feet of fill)	Southwest of the cooling tank, located south of the fine wire building and west of the heavy wire building.	To determine the impact of any chemicals that may have been released on the southwest side of the manufacturing building.
SS-3	4	Adjacent to the concrete slab, southwest of the heavy wire building.	To determine the impact of any chemicals that may have been released on the southwest side of the manufacturing building.
SS-4	4	South side of the heavy wire building.	To determine the impact of any chemicals that may have been released on the southwest side of the manufacturing building.
SS-5	5	Adjacent to the fence line north of Gate Number 2, northeast corner of the Techalloy plant.	To determine the impact of previous plant activities.
SS-6	5	Northwest of the acid house.	To determine the impact of any releases from the acid house.
SS-7	5	Adjacent to the concrete slab, east of the acid house and boiler room.	To determine the impact of any releases from the acid house.



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FIGURE 2-6



Three Hawthorn Parkway
Vernon Hills, Illinois
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PHASE II SOIL SAMPLE LOCATIONS
TECHALLOY COMPANY, INC.
Union, Illinois

The soil samples were collected and analyzed on site by Tracer Research Corporation (TRC) of Tucson, Arizona. TRC used a portable gas chromatograph to analyze headspace gas from soil samples. The soil samples were analyzed on site for 1,1,1-TCA, trichloroethene (TCE), and tetrachloroethene (PCE). The analytical results are summarized in Table 2-4.

Soil Investigations Related to Previous RCRA Closures

As previously discussed, on 8 February 1991, IEPA approved a RCRA facility closure plan for three SWMUs: the acid pits, the acid treatment unit, and the cyanide destruction unit. Those three SWMUs are distinct from the five SWMUs in the current RFI. Figure 2-4 illustrates the three SWMUs. As a part of the closure plan for the three SWMUs, WESTON conducted soil investigations in April 1991 and August 1992. The results of these investigations have been submitted to IEPA.

In April 1991, WESTON collected soil samples near the acid treatment unit, the acid pits, and the cyanide destruction unit. Five soil samples were collected below the concrete floor near the acid treatment unit. Thirty-two investigative soil samples were collected near the acid pits, 14 samples below the concrete floor within the acid house, and 18 samples outside the north wall of the acid house. Twenty-two investigative samples were collected near the cyanide destruction unit.

Soil samples collected near the acid treatment unit were determined to have significant total cyanide and PCE. Soil samples from below the concrete floor within the acid house did not have any significant concentrations of VOCs or inorganic constituents. Soil samples from outside the north wall of the acid house had significant total cyanide and lead (TCLP) concentrations. One soil sample each from the acid treatment unit and from north of the

Table 2-4

Phase II - Soil Probe Analytical Results (February 1991)
Techalloy Company, Inc.
Union, Illinois
(All Concentrations in $\mu\text{g}/\text{kg}$)

Sample No.	Date	Depth (ft)	TCA	TCE	PCE
SS-1	2/13/91	3	110	7	58
SS-2	2/13/91	6	22	7	85
SS-3	2/13/91	4	0.2	0.5	5
SS-4	2/14/91	4	2	0.2	0.9
SS-5	2/14/91	5	280	6	260
SS-6	2/14/91	5	58	1	16
SS-7	2/14/91	5	1,100	320	550
On-site objective	7/90	---	1,000	25	25

Notes:

TCA - 1,1,1-Trichloroethane.
 TCE - Trichloroethene.
 PCE - Tetrachloroethene.

acid pits had significant sulfate concentrations. Some soil samples collected near the cyanide destruction unit had significant cyanide concentrations.

In August 1992, WESTON collected soil samples from 10 soil borings located around the perimeter of the acid pits, the acid treatment unit, and the cyanide destruction unit. The samples were analyzed to determine the extent of inorganic soil contamination resulting from operations of the three RCRA units.

Lead and nickel (TCLP) were present at significant concentrations north and west of the acid pits. Lead and nickel were present at significant concentrations (TCLP) southwest of the acid treatment unit. Chromium, cyanide, and copper (TCLP) were also present at significant concentrations north of the west end of the acid pits. Analyses of samples from the north and south ends of the cyanide destruction unit did not indicate any cyanide in the soil.

2.4.2 Migration Pathways

Phase I Investigation

Groundwater is the main migration pathway of concern. The first groundwater investigation at the Techalloy facility took place in January 1990. As previously discussed, U.S. Testing, Inc. conducted a Phase I environmental assessment and subcontracted Roy F. Weston, Inc. (WESTON®) to perform the field work. This assessment is referred to as the Phase I investigation.

The Phase I investigation included groundwater sampling in former waste management areas or potential spill areas to determine if groundwater had been impacted. Three shallow monitoring wells (SP-01, SP-02, SP-04), and one deep monitoring well (WS-01) were

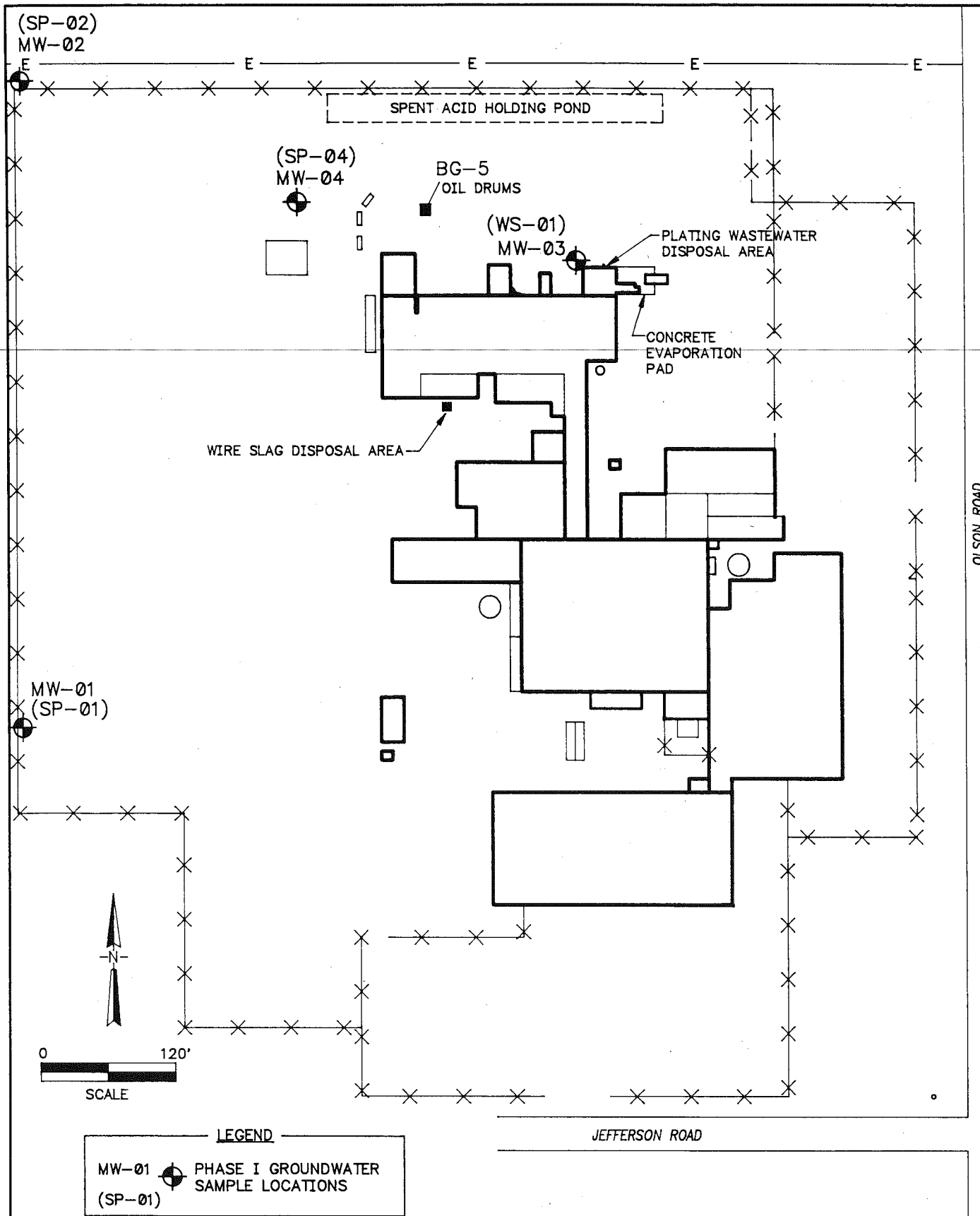
installed during the Phase I investigation. Subsequent investigations redesignated SP-01, SP-02 SP-04, and WS-01 as MW-1, MW-2, MW-4, and MW-3, respectively. Figure 2-7 shows the locations of these wells. Groundwater samples were collected from these wells and from City Well No. 2 and City Well No. 4. These city wells lie generally crossgradient (west) of the northwest groundwater flow from the Techalloy facility. Figure 2-8 shows the location of the city wells.

Based on the known historical use of solvents at Techalloy, groundwater samples were analyzed for VOCs. Results of the VOC analyses are shown in Table 2-5. VOCs were not detected above the method detection limits in City Well No. 2, City Well No. 4, or shallow well SP-01. However, wells SP-02, SP-04, and WS-01 were found to contain chlorinated hydrocarbons.

Phase I Follow-up Investigation (April 1990)

In April 1990, as a follow-up to the Phase I investigation, WESTON installed five additional shallow monitoring wells (MW-5, MW-6, MW-7, MW-8, and MW-9) and one deep monitoring well (MW-5D) along the western and northern property boundaries of the Techalloy facility. Figure 2-9 shows the locations of these wells. The purpose of the wells was to determine whether constituents were present at the property boundary and to determine the potential for off-site migration of constituents.

Groundwater samples were collected from the new wells and one Phase I well (MW-2) on 5 April 1990. Based on the known historical use of solvents and stainless steel at Techalloy, all samples were analyzed for VOCs and metals. The results are shown in Table 2-6. VOCs were present in groundwater at all the well locations sampled. The compounds 1,1,1-TCA and TCE were frequently detected. The U.S. EPA maximum contaminant levels (MCLs) were exceeded for 1,1,1-TCA (MCL-200 $\mu\text{g/L}$); TCE (MCL-5 $\mu\text{g/L}$); and PCE (MCL-5



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FIGURE 2-7



Three Hawthorn Parkway
Vernon Hills, Illinois
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PHASE I GROUNDWATER SAMPLE LOCATIONS
TECHALLOY COMPANY, INC.
Union, Illinois

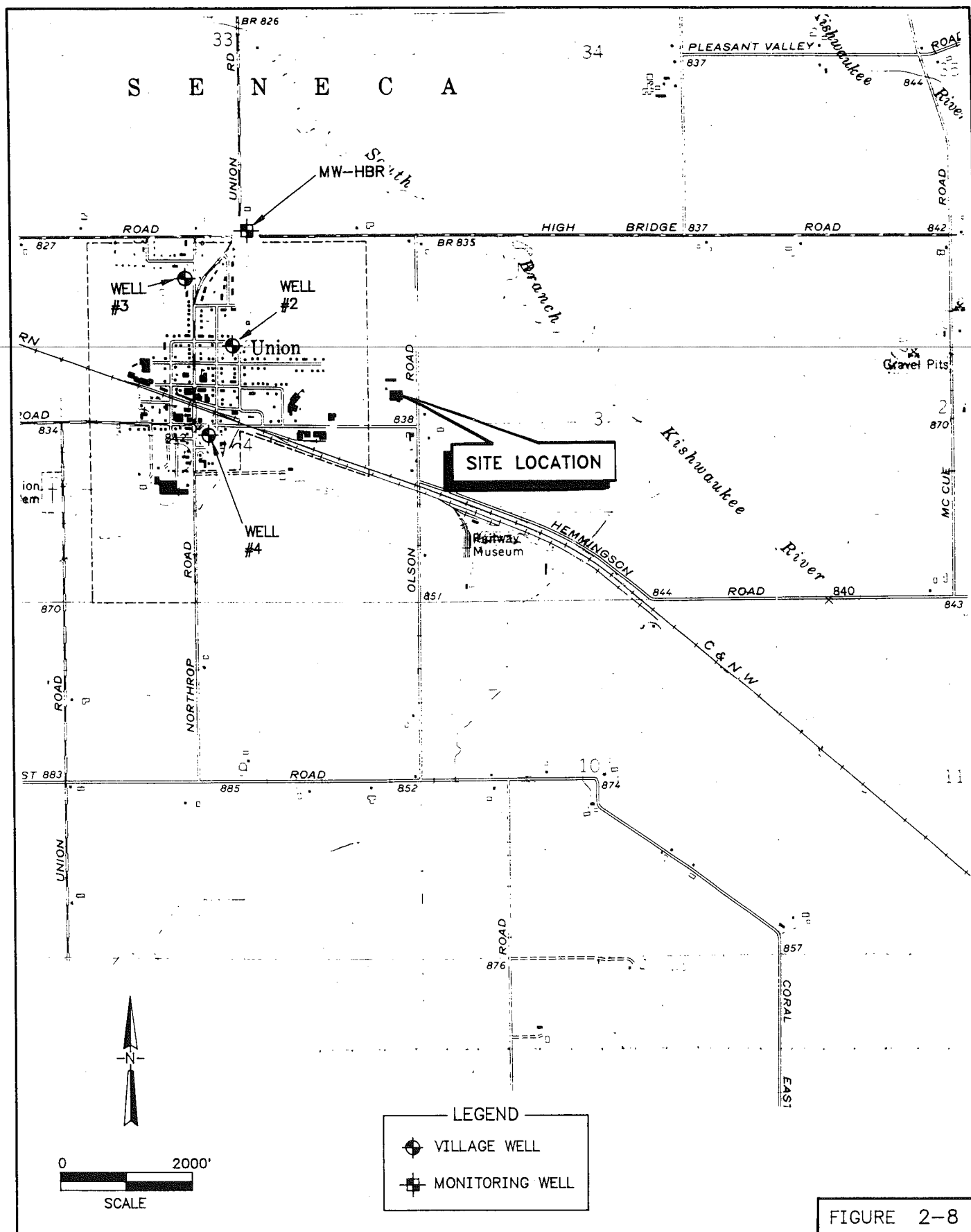
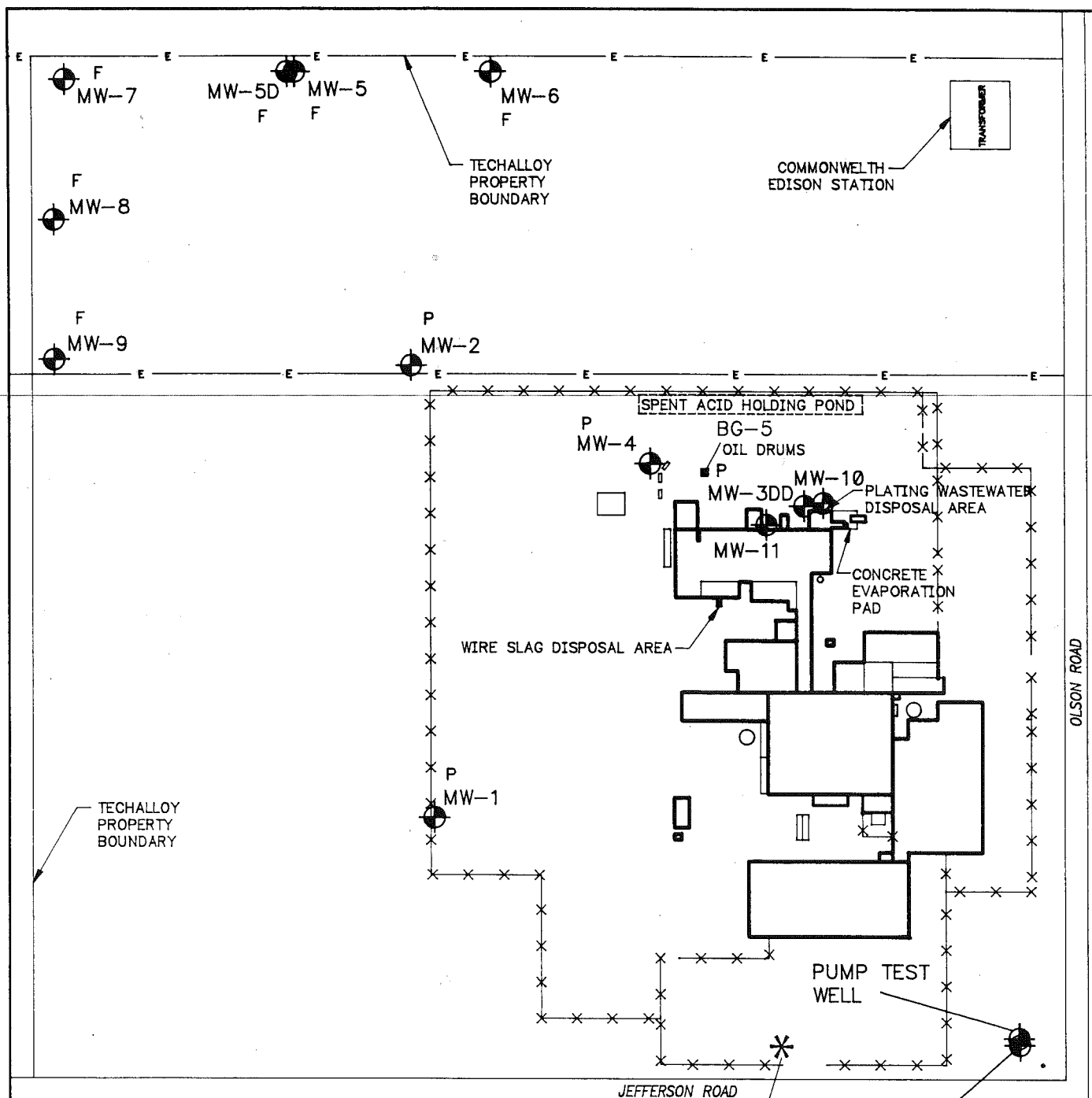


FIGURE 2-8

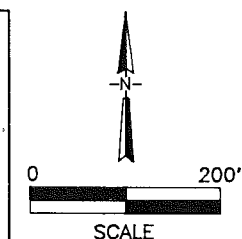


Three Hawthorn Parkway
Vernon Hills, Illinois
60061

PHASE I OFF-SITE
GROUNDWATER SAMPLE LOCATIONS
TECHALLOY COMPANY, INC.
Union, Illinois



LEGEND	
— x — x —	FENCE LINE
— E —	OVERHEAD ELECTRIC
⊙	EXISTING MONITORING WELL
MW-5D	EXISTING DEEP MONITORING WELL
MW-5	EXISTING SHALLOW MONITORING WELL
P	PHASE I WELLS
F	PHASE I FOLLOW-UP WELLS



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FIGURE 2-9



Three Hawthorn Parkway
Vernon Hills, Illinois
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PHASE I FOLLOW-UP WELLS
TECHALLOY COMPANY, INC.
Union, Illinois

Table 2-5

Phase I Groundwater Investigation Results (January 1990)
Techalloy Company, Inc.
Union, Illinois

Volatile Organic Compounds (VOCs) (µg/L)	City Well No. 2	City Well No. 4	SP-01 (MW-1)	SP-02 (MW-2)	WS-01 (MW-3)	SP-04 (MW-4)	Trip Blank	Field Blank
Methylene chloride	2 J	4 J	4 J	4 J	3 J	4 J	3 J	5
Acetone	35 B	7 JB	7 JB	6 JB	9 JB	4 JB	6 JB	14 B
1,1-Dichloroethene (DCE)	BDL	BDL	BDL	99	2 J	34	BDL	BDL
1,1-Dichloroethane (DCA)	BDL	BDL	BDL	89	8	44	BDL	BDL
1,2-Dichloroethene (total)(1,2-DCE)	BDL	BDL	BDL	36	11	16	BDL	BDL
2-Butanone	8 J	7 J	8 J	5 J	15	4 J	3 J	4 J
1,1,1-Trichloroethane (TCA)	BDL	BDL	BDL	2,100	BDL	1,100	BDL	BDL
Trichloroethene (TCE)	BDL	BDL	BDL	94	BDL	33	BDL	BDL
Tetrachloroethene (PCE)	BDL	BDL	BDL	150	BDL	190	BDL	BDL
Chloroform	BDL	4 J	4 J	BDL	BDL	BDL	BDL	BDL
4-Methyl-2-pentanone	BDL	3 J	3 J	BDL	17	BDL	BDL	BDL

BDL - Not detected.
 J - Estimated value below method detection limit.
 B - Indicates the compound was found in the blank and the sample.

Table 2-6
Phase I Follow-Up Groundwater Investigation Results (April 1990)
Techalloy Company, Inc.
Union, Illinois

Well No.	MW-5	MW-5D	MW-6	MW-6 Duplicate	MW-7	MW-8	MW-9	MW-2	Field Blank
Volatile Organic Compounds, µg/L									
Methylene chloride	5	4 J	5	5	24	5	BDL	BDL	BDL
Acetone	29	13	31	BDL	44	BDL	25	26	35
1,1-Dichloroethene	18	5	BDL	BDL	720	54	BDL	100	BDL
1,1-Dichloroethane	4 J	6	BDL	BDL	290	110	BDL	86	BDL
1,2-Dichloroethene (total)	7	2 J	BDL	BDL	77	18	BDL	30	BDL
Chloroform	BDL	BDL	BDL	BDL	4 J	BDL	BDL	BDL	BDL
1,2-Dichloroethane	BDL	BDL	BDL	BDL	11	BDL	BDL	BDL	BDL
1,1,1-Trichloroethane	1,100	300	14	12	15,000	1,500	18	3,000	7
Trichloroethene	27	300	BDL	BDL	520	130	BDL	99	BDL
1,1,2-Trichloroethane	BDL	BDL	BDL	BDL	35	BDL	BDL	6	BDL
Benzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
4-Methyl-2-pentanone	BDL	BDL	BDL	36	BDL	BDL	BDL	16	BDL
Tetrachloroethene	450	BDL	52	48	570	530	3 J	340	BDL
Metals, mg/L									
Arsenic, soluble	BDL	BDL	0.0094	0.0046	BDL	BDL	BDL	BDL	BDL
Lead, soluble	BDL	BDL	0.018	0.0070	BDL	BDL	BDL	BDL	BDL

BDL - Not detected.
 J - Estimated value below method detection limit.
 B - Indicates the compound was found in the blank and the sample.

µg/L). The levels of 1,1,1-TCA and PCE exceeded MCLs in the samples from MW-2, MW-5, MW-5D, and MW-8. The level of PCE detected in the samples from MW-2, MW-5, MW-6, MW-7, and MW-8 also exceeded the MCL. No metal analyzed was detected above U.S. EPA drinking water standards.

Phase I Follow-up Investigation (August 1990)

In August 1990, an off-site, downgradient monitoring well (MW-HBR) was installed along the county right-of-way adjacent to Union Road. The purpose of this well was to determine the downgradient extent of the constituent plume and its potential to affect private water wells located downgradient of the Techalloy property. Figure 2-8 shows the location of this well. During this sampling effort, groundwater samples were collected from MW-HBR, MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, MW-9, and one production well on site.

Based on the known historical use of solvents and metals at the facility, all samples were analyzed for VOCs and dissolved metals. There is no history of using semivolatile organic compounds (SVOCs) at the facility. However, for confirmation purposes, one sample (MW-7) was also analyzed for semivolatile organic compounds (SVOCs). The results of the analysis are shown in Table 2-7. No SVOCs analyzed were detected above method detection limits. The MW-HBR sample detected 1,2-dichloroethene (1,2-DCE), PCE, TCE, and 1,1,1-TCA at concentrations above the MCLs.

Phase II Investigation

In February 1991, WESTON began a Phase II investigation to further define the groundwater plume. Groundwater probe samples WS-1 through WS-21 were collected northwest of the Techalloy facility. The groundwater probe locations are shown in Figure

Table 2-7
Phase I Follow-Up Groundwater Investigation Results (August 1990)
Techalloy Company, Inc.
Union, Illinois

Parameter	Prod. Well	Field Blank	MW-01	MW-02	MW-03	MW-04	MW-05	MW-05D	MW-06	MW-07	MW-08	MW-09	HBR	HBR-Dup
Volatile Organic Compounds (µg/L)														
Methylene chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8	10	ND
1,1-Dichloroethene (1,1-DCE)	ND	ND	ND	ND	ND	190	210	ND	ND	85	ND	ND	120	110
1,1-Dichloroethane (1,1-DCA)	ND	ND	ND	ND	ND	200	95	ND	ND	59	5	ND	5	5
1,2-Dichloroethene (total) (1,2-DCE)	ND	ND	ND	ND	ND	97	48	ND	ND	24	ND	ND	8	8
1,2-Dichloroethane (1,2-DCA)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8	7
1,1,1-Trichloroethane (1,1,1-TCA)	ND	ND	ND	100	ND	6,000	5,600	310	39	2,800	190	ND	3,400	3,700
Trichloroethene (TCE)	ND	ND	ND	11	ND	270	110	270	ND	140	100	ND	24	24
1,1,2-Trichloroethane (1,1,2-TCA)	ND	ND	ND	ND	ND	18	9	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene (PCE)	ND	ND	ND	76	ND	1,000	620	ND	52	370	270	ND	320	310
Metals, Soluble (mg/L)														
Copper, Soluble	0.021	ND	ND	ND	ND	ND	ND	0.043	ND	ND	ND	ND	ND	ND
Lead, Soluble	0.0029	0.0027	0.0020	0.0037	ND	0.0032	ND	0.0084	0.036	0.0072	0.0028	0.0034	ND	0.0021
Mercury, Soluble	ND	ND	ND	0.0021	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic, Soluble	ND	ND	ND	ND	0.0043	ND	ND	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA

ND - Not detected.
 NA - Not analyzed.

2-10. These locations were selected to delineate the downgradient and lateral extent of affected groundwater on and downgradient of the Techalloy property.

Groundwater probe samples were collected and headspace gas was analyzed in the field for TCA, TCE, and PCE. A summary of the detected compounds is presented in Table 2-8.

As a confirmatory measure, a second groundwater sampling effort was undertaken. This effort entailed collection of groundwater samples in screened hollow-stem augers and chemical analysis. Groundwater auger samples TW-1 through TW-4 were situated within the plume boundary as delineated by groundwater probe sample analyses. The auger sample locations are also depicted in Figure 2-10. A summary of the detected compounds is presented in Table 2-9. Figure 2-10a depicts the groundwater plume based on available total volatile organics data. As can be seen in the figure, the overall configuration of the plume is very similar to Figure 2-10. The highest total volatile organic concentrations are found on the north and northwest portion of the Techalloy facility.

Figures 2-10b through 2-10e represent cross sections through the groundwater plume. These figures show the vertical distribution of VOCs present.

Based on the Phase II combined analytical results from groundwater probe and groundwater auger samples, WESTON believes a groundwater plume originates from the northern half of the Techalloy plant area. The plume is migrating in a northwestward direction and appears to extend to, and slightly beyond, common sampling points WS-20 and TW-1, northwest of the intersection of Highbridge and Union Roads. This is a distance of approximately 4,900 feet from the Techalloy plant. Based on the plume configuration and constituent levels, the plume is believed to terminate just northwest of the sample points WS-20 and TW-1. The cross-section dimensions of the plume have also been assessed. At the facility, the plume is approximately 700 feet wide and 35 feet deep. At approximately

1,600 feet downgradient of the facility, the plume is approximately 800 feet wide and approximately 80 feet deep. At approximately 3,200 feet downgradient from the facility, the plume starts to narrow and is approximately 400 feet wide and 85 feet deep. At approximately 4,000 feet downgradient from the facility, the plume thins to approximately 150 feet wide. The VOC that has migrated the farthest downgradient is TCE, which was

Table 2-8
Phase II - Groundwater Probe-Headspace Analytical Results (February 1991)
Techalloy Company, Inc.
Union, Illinois
(Concentrations in $\mu\text{g/L}$)

Sample No.	Date	Depth (ft)	1,1,1-TCA	TCE	PCE
WS-1	2/12/91	10	0.74	0.95	0.004
WS-2	2/12/91	13	5.6	0.95	4.5
WS-3	2/12/91	9	3,748	381	754
WS-4	2/12/91	13	18,177	95	3,618
WS-5	2/12/91	7	0.18	0.95	1
WS-6	2/13/91	7	0.93	0.76	0.45
WS-7	2/13/91	10	0.74	0.76	0.45
WS-8	2/13/91	7	206,131	38	1,809
WS-9	2/14/91	7	0.93	0.57	0.6
WS-10	2/15/91	6	1,124	57	1,206
WS-11	2/28/91	7	56	1.9	15
WS-12	2/28/91	7	0.93	0.57	0.3
WS-13	2/28/91	9	1.3	0.57	4.5
WS-14	2/28/91	10	131	1.7	30
WS-15	2/28/91	7	0.37	0.57	0.15
WS-16	2/28/91	7	0.74	0.57	0.3

Table 2-8

Phase II - Groundwater Probe-Headspace Analytical Results (February 1991)
Techalloy Company, Inc.
Union, Illinois
(Concentrations in $\mu\text{g/L}$)
(Continued)

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Sample No.	Date	Depth (ft)	1,1,1-TCA	TCE	PCE
WS-17	2/28/91	8	0.74	0.19	0.15
WS-18	2/28/91	8	3.7	0.19	0.3
WS-19	3/1/91	8	75	11	0.75
WS-20	3/1/91	8	5.6	0.19	0.45
WS-21	3/1/91	8	1.4	0.19	0.15
On-site objective	1990	---	1,000	25	25
Off-site objective	1990	---	200	5	5

Table 2-9
Phase II - Groundwater Auger Samples Analytical Results (February 1991)
Techalloy Company, Inc.
Union, Illinois
(Concentrations in $\mu\text{g/L}$)

Sample	Date	Depth (ft)	1,1,1-TCA	(DL)	TCE	(DL)	1,2-DCA	(DL)	1,1-DCA	(DL)	1,2-DCA	(DL)
TW-1	4/3/91	25	19	(5)	13	(5)	ND	(5)	ND	(5)	ND	(5)
TW-2	4/4/91	25	730	(25)	29	(5)	38	(5)	ND	(5)	ND	(5)
TW-3	4/4/91	25	8	(5)	8	(5)	ND	(5)	ND	(5)	ND	(5)
TW-3 Duplicate	4/4/91	25	10	(5)	23	(5)	ND	(5)	7	(5)	ND	(5)
TW-3-75'	4/8/91	75	ND	(5)	590	(25)	320	(25)	650	(25)	120	(25)
TW-4	4/8/91	25	ND	(5)	ND	(5)	ND	(5)	ND	(5)	ND	(5)
TW-4-75'	4/9/91	75	ND	(5)	ND	(5)	ND	(5)	ND	(5)	ND	(5)
Off-site objective	1990	---	1,000	0.3	25	1.2	35	1.3	NA	NA	25	0.3
On-site objective	1990	---	200	0.3	5	1.2	7	1.3	NA	NA	5	0.3

DL - Detection limit.
 ND - Not detected.
 NA - Not applicable.

detected at test well TW-1 at a concentration of 13 $\mu\text{g/L}$. Based on this data, it is interpreted that the plume diminishes within an estimated 200 feet northwest of TW-1.

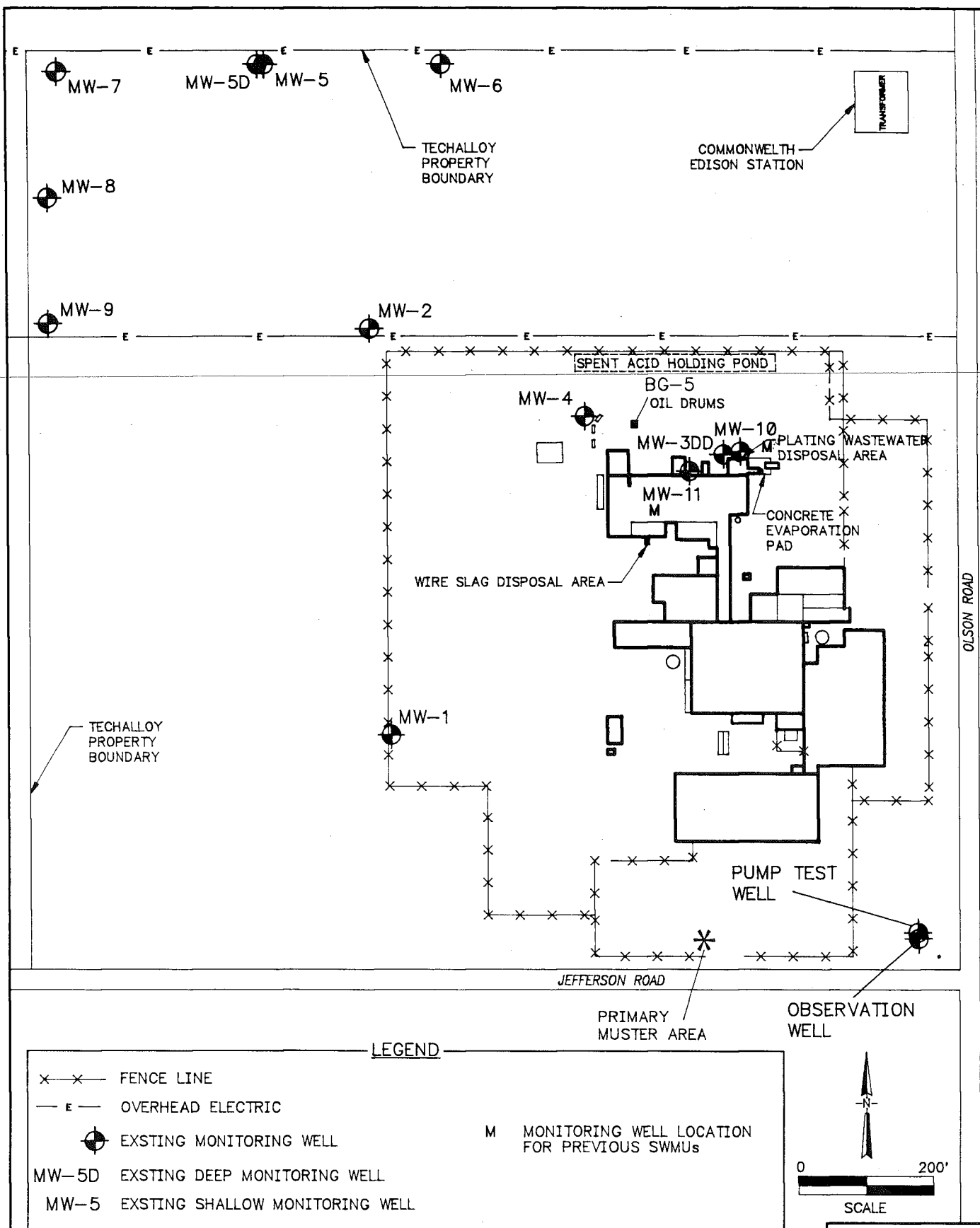
Groundwater Investigation Related to Previous RCRA Closures

In July 1992, WESTON installed two shallow monitoring wells (MW-10 and MW-11) on the property (Figure 2-11). The wells were installed primarily to assess the occurrence of metal constituents from the acid house that may have migrated to the shallow groundwater. This investigation was performed to determine the type of RCRA closure appropriate for the units undergoing RCRA closure. MW-10 was placed near the previous plating wastewater discharge sump and directly downgradient of the TCA disposal area. MW-11 was placed directly downgradient of the acid house. These wells were sampled along with the existing well MW-4 and analyzed for VOCs, cyanide, metals, and other inorganics. The analytes were chosen to reflect the chemicals historically used at the Techalloy facility. The results of the groundwater analyses are summarized in Table 2-10. These results showed that nickel and nitrate were the only inorganic constituents that exceeded their respective IEPA cleanup objectives. VOCs were also detected above their respective cleanup objectives (Table 2-10), with the most detections occurring at MW-10, located immediately downgradient of the concrete evaporation pad.

2.5 NATURE AND EXTENT OF CONTAMINATION

The previous investigations have carefully analyzed the soils and groundwater in general around the facility. As a result, it is possible to describe the nature and extent of the facility's environmental conditions.

As previously discussed, the present location of the Techalloy facility was farmland prior to 1960. The facility has operated as a wire manufacturer since 1960. As a result, the nature



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FIGURE 2-11



Three Hawthorn Parkway
Vernon Hills, Illinois
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MONITORING WELLS
FOR THREE PREVIOUS SWMUs
TECHALLOY COMPANY, INC.
Union, Illinois

Table 2-10

**Previous RCRA Closure Groundwater Investigation (July 1992)
 Techalloy, Inc.
 Union, Illinois
 (Concentrations in $\mu\text{g/L}$)**

Analyte/Chemical	MW-04	MW-10	MW-11	CUO (March 1992)
Inorganics				
Barium	BDL	110	BDL	2,000
Chromium	56	BDL	BDL	100
Copper	BDL	BDL	220	650
Nickel	31	38	6,000	100
Lead	3.0	BDL	BDL	7.5
Selenium	BDL	2.1	BDL	50
Nitrate	19,400	660	48,500	10,000
Sulfate	24,000	BDL	6,600	400,000
Cyanide	BDL	BDL	17	200
Organics				
1,2-Dichloroethene (total)	BDL	780	BDL	5
1,1-Dichloroethane	BDL	4,900	12	700
1,1,1-Trichloroethane	690	320,000	190	200
1,1-Dichloroethene	BDL	9,500	BDL	7
Toluene	BDL	240	BDL	1,000
Xylene (total)	BDL	110	BDL	10,000
Trichloroethene	BDL	10,000	9	5
Tetrachloroethene	670	4,800	66	5
Methylene chloride	BDL	170	BDL	5
1,1,2-Trichloroethane	BDL	130	BDL	5

CUO - Cleanup objective.
 BDL - Below detection limit.

and extent of constituents are typical of a small wire manufacturing facility. Localized occurrences of acids, metals, and solvents are contained in the soils on the property. The groundwater both within the Techalloy property and downgradient beyond the facility boundary contains certain chlorinated volatile organics. Figure 2-10 illustrates the present extent of the groundwater plume.

2.5.1 Source Areas

The source areas at the facility are a collection of processing and former disposal areas, which are currently designated as RCRA SWMUs. The soils in the source areas contain certain VOCs and process-related metals. Like the facility as a whole, the identities of contaminants at individual SWMUs are also well understood. However, the precise spatial distributions of constituents at each SWMU are not known. Only one SWMU, the BG-5 Drum Storage Area, has not been sampled to date.

Eight SWMUs have been identified at the Techalloy facility, three of which are already being addressed under a separate closure plan. Table 2-11 lists the three SWMUs addressed by the separate closure plan. Because the three separate SWMUs are the subject of a separate investigation, this summary of current conditions does not address these three SWMUs in detail. Table 2-12 lists the five SWMUs addressed by the present RFI, which are the focus of the present summary of current conditions.

Wire Slag Disposal Area

The soil at the Wire Slag Disposal Area has been sampled as part of the investigation for the closure of the acid treatment unit. The soil samples (TT-3 and TT-4) were collected on the south side of the building, immediately east and west, respectively, of the Wire Slag Disposal Area. The soil was analyzed for inorganics, TCLP metals, and VOCs. According

Table 2-11

Previous RCRA Closure SWMUs
Techalloy Company, Inc.
Union, Illinois

SWMU	Suspected Constituents	Current Status
Cyanide Tank (also known as Cyanide Destruction Unit)	Cyanide, metals.	Tanks have been abandoned, dismantled, and are undergoing closure.
Acid Pits (also known as Acid House or Acid Pickling House)	Acids, metals.	Pits have been retrofitted are still in use, and are undergoing RCRA closure.
Acid Treatment Unit	Acids, metals.	Unit is no longer in use. Tanks have been abandoned, dismantled, and are undergoing closure.

Table 2-12

SWMUs Addressed by the Present RFI
Techalloy Company, Inc.
Union, Illinois

SWMU	Suspected Constituents	Current Status
Wire Slag Disposal Area	VOCs, metals (especially barium).	Actively used as a forklift driveway and a dumpster holding area for a single dumpster. The dumpster contains only solids. The area is paved to prevent infiltration.
BG-5 Drum Storage Area	VOCs, metals.	Inactive. Used to store discarded containers unrelated to BG-5.
Concrete Evaporation Pad	VOCs (especially PCE and 1,1,1-TCA), metals (specifically, lead and barium).	Inactive since 1978. Soil may harbor residual constituents serving as continuing source.
Spent Acid Holding Pond (also known as Settling Pond)	VOCs, metals (especially chromium).	Inactive since 1980.
Plating Wastewater Disposal Area	VOCs, metals, cyanide.	Inactive since 1979.

to the analyses, levels of methylene chloride, 1,1,1-TCA, PCE, and TCLP barium are present. Only methylene chloride and PCE were reported above the IEPA cleanup objectives.

BG-5 Drum Storage Area

The BG-5 area is isolated from the previously investigated areas. As a result, no soil or groundwater samples are available in the immediate vicinity of the BG-5. BG-5 is the location of two drums containing cutting oil, so it is primarily composed of petroleum compounds. Used cutting oil would contain VOCs and possibly traces of metals. As a result, it may be suspected that VOCs or metals could be present in the soil.

Concrete Evaporation Pad

A soil boring (SB-12, also identified as SS-01) is located near the Concrete Evaporation Pad. The soil was analyzed for VOCs. The analyses indicate an influence from the SWMU. Detected analytes include 1,1-DCE; 1,1-DCA; 1,1,1-TCA; TCE; 1,1,2-TCA; PCE; toluene; ethylbenzene; and xylenes. 1,1,1-TCA was detected at a concentration of 1,000,000 $\mu\text{g}/\text{kg}$. PCE was also detected at a concentration of 870,000 $\mu\text{g}/\text{kg}$. It is suspected that the Concrete Evaporation Pad is the primary origin of the groundwater plume migrating northwestward from the facility (Figure 2-10).

Soil boring SB-12 was also analyzed for TPH, inorganics, and metals. Concentrations of TPH, lead, and barium were detected.

Spent Acid Holding Pond

A soil boring (SB-05) is located in the Spent Acid Holding Pond (also known as the Settling Pond). The soil was analyzed for inorganics, TPH and metals. The location of the soil boring is shown on Figure 2-5, and the data is summarized on Table 2-1. The laboratory results suggest that concentrations of chromium occur within the soil of the pond, but TPH was not detected. Additionally, concentrations of arsenic, barium, cadmium, and sulfate were also detected.

A headspace analysis was performed on a groundwater probe sample (WS-8) at the Spent Acid Holding Pond. The mobile laboratory GC determined that the headspace gas contained levels of 1,1,1-TCA and PCE.

Plating Wastewater Disposal Area

A groundwater monitoring well (MW-10) is located in the Plating Wastewater Disposal Area. The water from MW-10 has been analyzed for inorganics and VOCs. The analyses indicate that the water contains levels of 1,2 DCE; 1,1-DCA; 1,1,1-TCA; 1,1-DCE; toluene; xylenes; TCE; PCE; methylene chloride; and 1,1,2-TCA.

Laboratory data shows that metals and cyanide do not seem to have affected the groundwater; however, metals or cyanide may be present in the soil.

2.5.2 Migration Pathways

The migration pathway of concern is the transport of constituents in groundwater. Airborne transport and surface water runoff are of relatively little concern, as the facility is partially covered with buildings, and some of the remaining area is paved. Unpaved areas do cover a large area of the facility, but the facility occasionally places sand and gravel over unpaved

surfaces to facilitate operations. The facility is surrounded by a security fence to prevent access.

During prior investigations, WESTON monitored for airborne organic constituents using field instruments. The monitoring detected no elevated levels of organic constituents. The monitoring confirms the expectation that the airborne pathway is of little concern.

Groundwater is the principal pathway of concern. The groundwater is known to contain certain VOCs and process-related metals. Numerous groundwater samples have been collected downgradient of the Techalloy property and are summarized in Figure 2-7. Based on analyses of the groundwater, it appears that VOCs are the primary constituents transported. The variations in transport are due to the transport characteristics of the constituents.

Based on numerous observations of downgradient groundwater quality, it is possible to draw several conclusions regarding the groundwater pathway. The following conclusions regard VOCs, SVOCs, and metals:

- VOCs are present in the groundwater plume, which is migrating beyond the property. Figure 2-10 illustrates the plume. A report by WESTON provides extensive documentation of this migration pathway. (WESTON, "Phase II Soil and Groundwater Investigation: Techalloy Company, Union, Illinois", June 1991.) (Appendix A).
- SVOCs are not migrating in the groundwater. The facility has no history of SVOC usage, and none were found on site during previous investigations. Furthermore, a downgradient monitoring well (MW-7) directly in the constituent plume was tested for SVOCs and indicated no detections (Figure 2-10).
- Metals are present, but are not migrating off site. Although monitoring wells and soil samples at the source areas display significant levels of metals, the

monitoring wells downgradient do not. For instance, the monitoring wells at the northwest corner of the property appear unaffected. Monitoring wells, such as MW-7 (Figure 2-10), were analyzed for metals and no metals of potential concern were detected.

2.5.3 Potential Receptors

Presently, only a limited number of potential receptors exist, none of which are related to municipal water wells. The potential receptors are restricted to residential water wells.

Several present and former community water wells are nearby, but they are not receptors. The Village has installed a new production well (Well No. 4) for the community water system. The new water well lies far outside the potential extent of the groundwater plume, and it also extracts water from a much deeper stratum than the stratum in which the groundwater plume lies. The active Village well (Well No. 4) was tested for VOCs in January 1990, and neither TCE nor 1,1,1-TCA were detected.

An inactive Village well (Well No. 3) exhibited elevated levels of ammonia, sulfates, chlorides, sodium and potassium. (PRC Consultants, "Preliminary Assessment: Techalloy Illinois, Inc.", 8 November 1991.) The reported constituents found at the inactive well are primarily inorganic constituents while the plume emanating from Techalloy consists of VOCs. A chemical company, located southwest of the Techalloy facility, has been identified as a potential source of inorganic contamination. The well ceased production in 1987. (Ibid.)

Seventeen residential wells lie in the vicinity of the groundwater plume. Twelve residential wells are identified as potential receptors as summarized on Table 2-12a. These wells have been tested for VOCs on various occasions from June 1990 to September 1991. The residential well sampling history and planned sampling events are presented in the document "Private

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Table 2-12a

Potential Residential Well Receptors
Techalloy Company
Union, Illinois

[illegible]

Well Sampling Plan: Techalloy Company, Union, Illinois", February 1993. Six of the wells had detectable concentrations of VOCs; however, only one well exceeded an MCL, exhibiting TCE at a concentration above 5.0 $\mu\text{g/L}$.

None of these private residences use their water wells for potable water, as these wells are artifacts. All of these residences are supplied with Village of Union municipal water. In compliance with the consent order for the facility, the details of the investigation of potential receptors is presented separately. (See WESTON, Private Well Sampling Plan, February 1993.) This RFI Work Plan does not address the private well sampling plan.

SECTION 3

IMPLEMENTATION OF INTERIM MEASURES

The interim corrective measures will be implemented to provide a remedy of the VOCs in the groundwater migrating downgradient of the Techalloy property. Due to the magnitude and extent of the known groundwater constituents, U.S. EPA has determined that the initiation of a remedy cannot wait until completion of the RFI/CMS. The interim measures to be implemented will include pumping affected groundwater and treating it to acceptable levels to meet applicable laws for the method of disposal used.

In accordance with the requirements of the Consent Order, Techalloy submitted the Interim Measures Work Plan to U.S. EPA and IEPA for review in March 1993. This work plan outlines the scope of work, the technical approach (concept design), the project team, and the project schedule for the Interim Measures.

The concept design provides the conceptual groundwater extraction system, the treatment and discharge system, and the regulatory drivers. The concept design also identifies major components of the cleanup system along with approximate sizes, and identifies significant data gaps that must be resolved before the Final Design. This concept design was provided to the U.S. EPA for review and comments before the Final Design.

The proposed system will extract the groundwater plume through a packed tower aerator (PTA), in order to prevent further migration of affected groundwater. The treated effluent will be discharged to the nearby South Branch of the Kishwaukee River.

After approval of the Final Design and the permit applications, the interim measures will be implemented. These measures will include the following activities:

- Installation of the extraction well.
 - Fabrication of the PTA system.
 - Selection of construction subcontractor.
 - Installation of discharge pipes, pad, and other structures.
-
- Installation of the PTA system.
 - Startup of the treatment system.
 - Final adjustment to the treatment system.



Table 4-5

**Technology-Dependent Data Needs for Groundwater
Techalloy Company, Inc.
Union, Illinois**

Response Action	Data Needs
Land survey	State-plane coordinates and elevation of piezometric surface
Aquifer pumping test	Transmissivity and storativity in the uppermost aquifer and permeability of the uppermost aquitard
Geotechnical laboratory	Bulk density, particle density, fraction organic carbon, grain size distribution
Physical/chemical	COD, TSS, TDS, nitrogen, phosphorous, sulfur, hardness, pH
Biological	BOD ₅ , BOD, ignitability, corrosivity, reactivity, TCLP extract, TWA for listed waste

4.6 TREATABILITY STUDIES

Although treatability studies should be performed at the earliest feasible stage of the RFI/CMS process, this work plan cannot specify any particular treatability studies at present. At the outset of the RFI, the investigation should focus on locating the media constituents and screening the candidate technologies. Once the constituents are adequately understood and the technologies are screened, treatability studies may be conducted as applicable.

4.5.3 Technology-Dependent Data for Groundwater

As with soil technologies, most potentially applicable technologies for remediating groundwater require specialized information to support a detailed evaluation. For groundwater, the technologies of containment, extraction, in situ bioremediation, ex situ biotreatment, and physical/chemical treatment each prompt the need for additional data.

<u>Technology</u>	<u>Data Needs</u>
Containment	Determination of the depth and configuration of the piezometric surface, hydraulic conductivity, bulk density, and particle density of the uppermost water-bearing zone.
Extraction	Hydraulic information on the uppermost water-bearing zone, encompassing the piezometric surface, hydraulic conductivity, and fraction organic carbon.
Biological Treatment	Measurement of 5-day biochemical oxygen demand (BOD ₅), ultimate biological demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), total dissolved solids (TDS), dissolved oxygen (DO), nitrogen, phosphorous, and sulfur.
Physical/Chemical Treatment	Determination of COD, TSS, TSD, hardness, and pH.

Table 4-5 summarizes the additional technology-specific data needs for groundwater. This table sorts the tests according to the type of test and eliminates duplication among the testing needs of the various technologies. Some of these tests will be conducted during the Phase I RFI activities. Additional tests may be conducted, if deemed necessary, after completion of the Phase I RFI activities.

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Table 4-4

Technology-Dependent Data Needs for Soil
Techalloy Company, Inc.
Union, Illinois

Response Action	Data Needs
Land survey	State-plane coordinates and elevations of ground surface above mean sea level
Geotechnical laboratory	Moisture content, bulk density, particle density, fraction organic carbon, grain size distribution
Field geotechnical	Vapor permeability
RCRA disposal parameters	Ignitability, corrosivity, reactivity, TCLP extract, total weight analysis (TWA) for listed waste
Analytical laboratory (physical/chemical/biological)	Suspended solids, biochemical oxygen demand, total organic carbon, dissolved oxygen, nutrient analysis (ammonia, nitrate, phosphate, etc.), pH
Thermal	Heat content, ash content, ash characteristics, halogen content

<u>Technology</u>	<u>Data Needs</u>
Physical/Chemical Treatment	Bulk density, moisture content, particle density, fraction organic carbon, hydraulic conductivity, vapor permeability, grain size distribution, suspended solids, pH, and constituent analysis.
Biological Treatment	Determine biodegradability of organic constituents to process microbes, biochemical oxygen demand (BOD), total organic carbon, dissolved oxygen, nutrient analysis (ammonia, nitrate, phosphate), pH, and temperature.
Thermal Treatment	Determine heat content, volatile matter content, ash content, ash characteristics, halogen content, moisture content, and heavy metal content for the purpose of reactor design. Includes the data needed for physical treatment processes for the purpose of feed mechanism design.

Table 4-4 summarizes the additional technology-dependent data needs for soil. The table sorts the tests by the type of test and thereby eliminates duplication among the testing needs of the various technologies. Some of these tests will be conducted during Phase I RFI activities. Additional tests may be conducted, if deemed necessary, after completion of the Phase I RFI activities.

Based on the historical database regarding constituent concentrations in soils, certain physical treatment technologies such as soil vapor extraction may not be applicable. Therefore, vapor permeability will not be obtained unless subsequent RFI data suggests that soil vapor extraction is a viable alternative.

4.5.2 Technology-Dependent Data for Soil

Data on constituents and spatial extent of affected media are necessary, but not sufficient, to support a rigorous evaluation of technologies. Most technologies require additional, technology-specific engineering information if they are to be accurately evaluated. Even so, at the technology-evaluation level, exhaustive collection of technology-dependent data is not warranted. Instead, a limited number of representative samples for each engineering parameter can support the technology evaluation. This limited approach recognizes that most technologies will never actually be used at the Techalloy facility. After subsequent development and selection of corrective measure alternatives, any applicable technology-specific data can be analyzed in greater number and detail to support the design of the chosen technology.

For soil, the process options of capping, excavation, landfilling, solidification/stabilization, physical/chemical treatment, biological treatment, and thermal treatment each prompt the need for additional screening data as described below.

<u>Technology</u>	<u>Data Needs</u>
Capping	A topographic survey of the property.
Excavation	Measurement of moisture content and bulk density of the soil.
Landfilling	Measurement of moisture content and bulk density. Also requires evaluation of whether the material is a RCRA hazardous waste; that is, the material must be tested for ignitability, corrosivity, reactivity, TCLP extract constituents, and listed constituents.
Solidification/Stabilization	TCLP extraction and analysis. Additionally, the data required for physical/chemical treatment processes is also needed.

Table 4-3

**Summary of Potentially Applicable Corrective Measure
 Technologies for Groundwater
 Techalloy Company, Inc.
 Union, Illinois**

Response Action	Process Option	Corrective Measure Technology
No Action	None	None
Containment	Vertical barriers	None
	Groundwater extraction	Containment wells
Extraction	Trenches	None
	Wells	Extraction wells
	Drains	None
In situ treatment	Biological/biochemical	Methanotropic biodegradation Reductive dechlorination
	Physical/chemical	Air sparging Permeable treatment bed with metal catalysts
Treatment on site	Physical/chemical treatment	Precipitation Air stripping Carbon adsorption Oxidation
Treatment off site	Transport to off-site RCRA facility	Treatment at off-site RCRA-licensed facility
Discharge	Surface outfall	Discharge treated/untreated water to surface water body
Monitoring	Groundwater	Use existing and newly installed monitoring wells

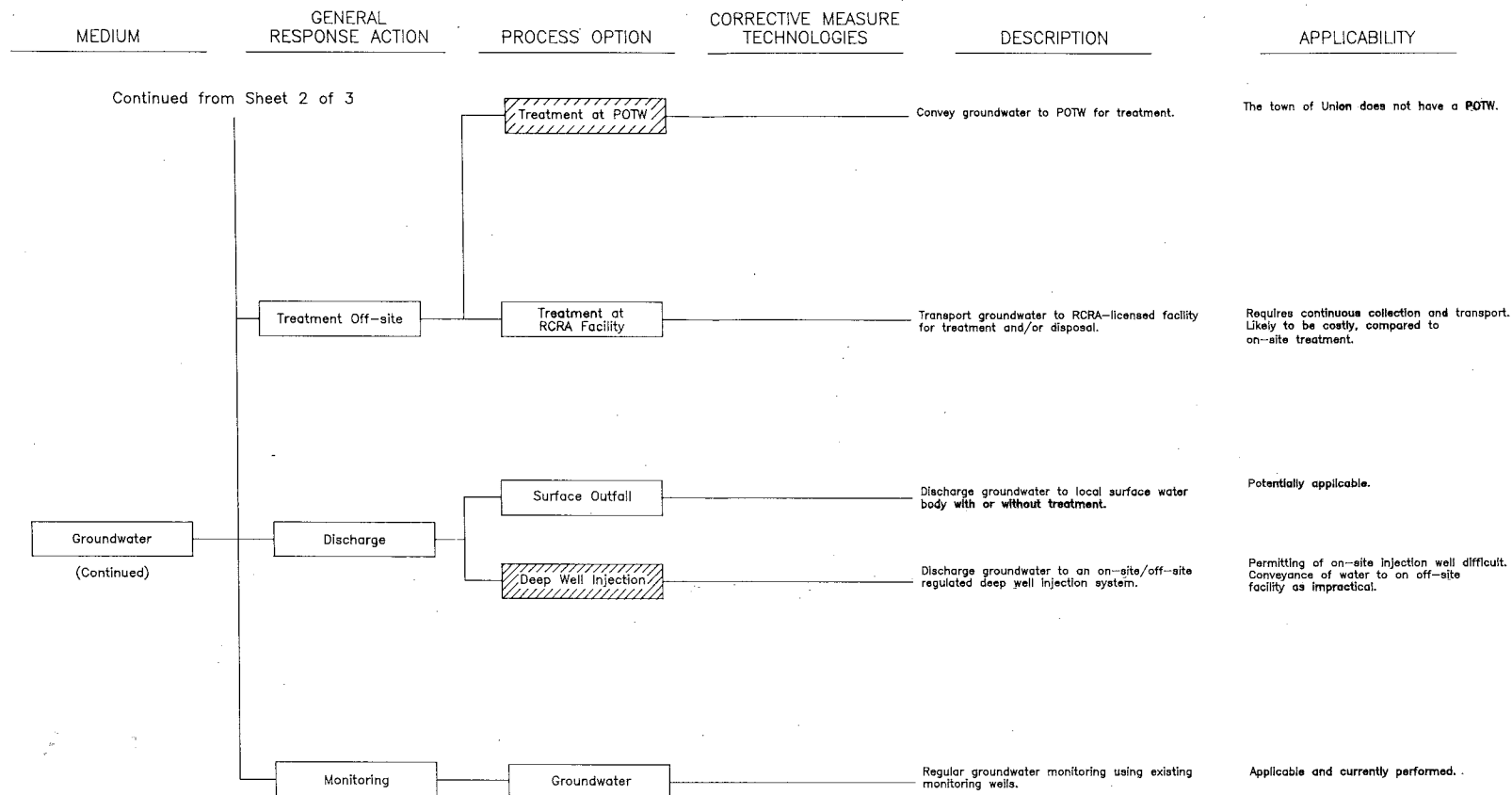
well injection. Table 4-3 provides the summary of potentially applicable corrective measure technologies for treating chemical constituents that may be present in the groundwater.

4.5 DATA GAPS

Previous studies have initiated the characterization of the soil and groundwater affected by Techalloy operations. Even so, the RFI must address additional data needs in anticipation of the CMS. The existence of additional data needs does not imply any inadequacy of the previous studies; rather, it reflects the special emphasis on engineering for the future CMS. The previous studies focused on the scientific issue of whether a release has occurred at the facility. The RFI, in contrast, must support additional engineering concerns of spatially defining any constituents and, where necessary, ultimately screening corrective measure alternatives. The following discussion explains the RFI's additional spatial and technology-dependent data needs.

4.5.1 Spatial Extent of Constituents

The RFI activities address the existing data gaps in characterizing the spatial extent of constituents. The scope of the RFI includes determining the vertical and horizontal extent and magnitude of constituents in the source areas and constituent migration in groundwater. Such information, together with the cleanup objectives, is the starting point for screening and design of any corrective measure alternatives that might be considered for the facility. The RFI activities related to characterizing spatial extent of constituents are described in the Project Management Plan (Section 5).



LEGEND



Technology screened out

FIGURE 4-2



Three Hawthorn Parkway
Vernon Hills, Illinois
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TECHNOLOGY SCREENING for
GROUNDWATER TREATMENT - Sheet 3 of 3
TECHALLOY COMPANY, INC.
Union, Illinois

REV. B

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MEDIUM

GENERAL
RESPONSE ACTION

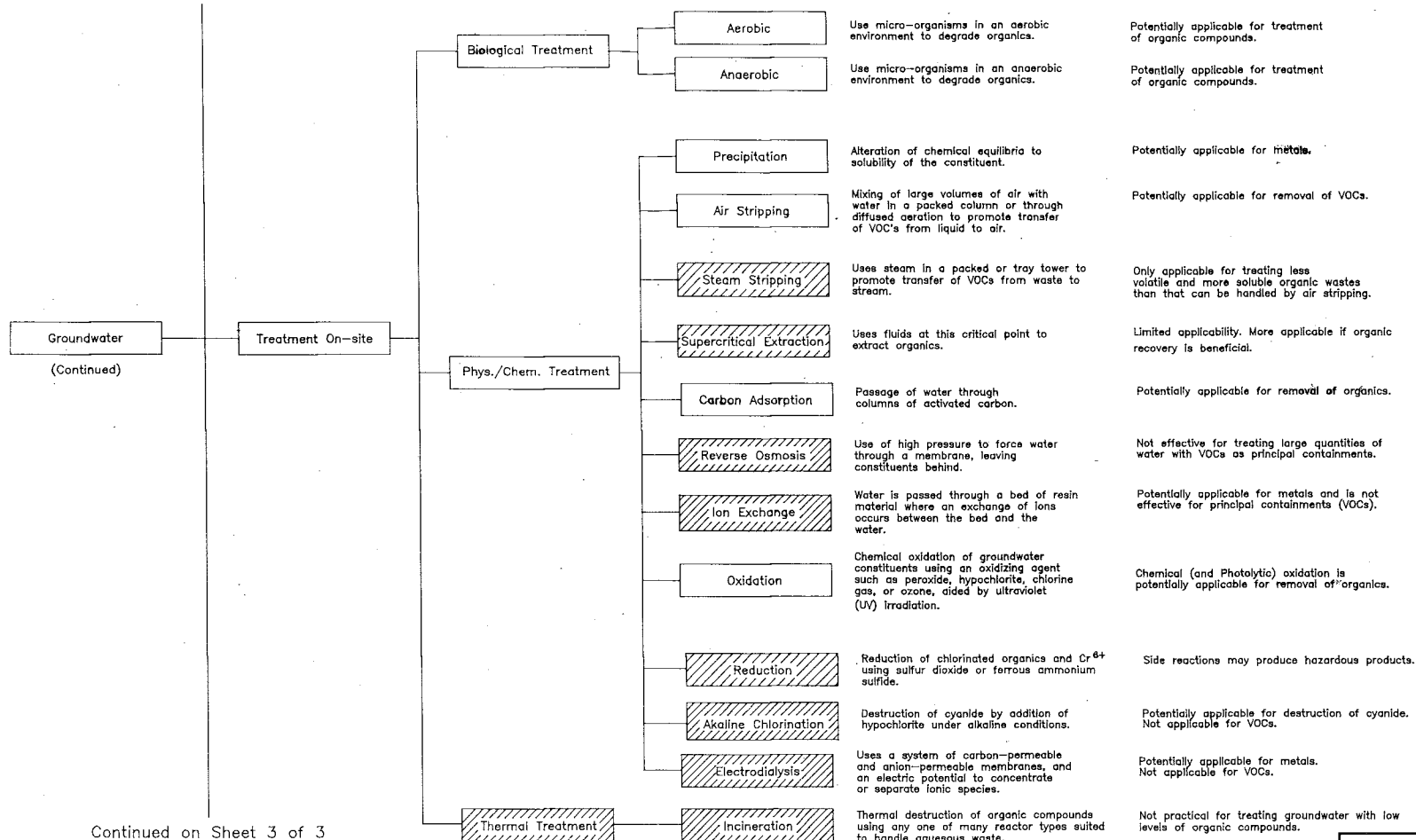
PROCESS OPTION

CORRECTIVE MEASURE
TECHNOLOGIES

DESCRIPTION

APPLICABILITY

Continued from Sheet 1 of 3



LEGEND



Technology screened out

Continued on Sheet 3 of 3

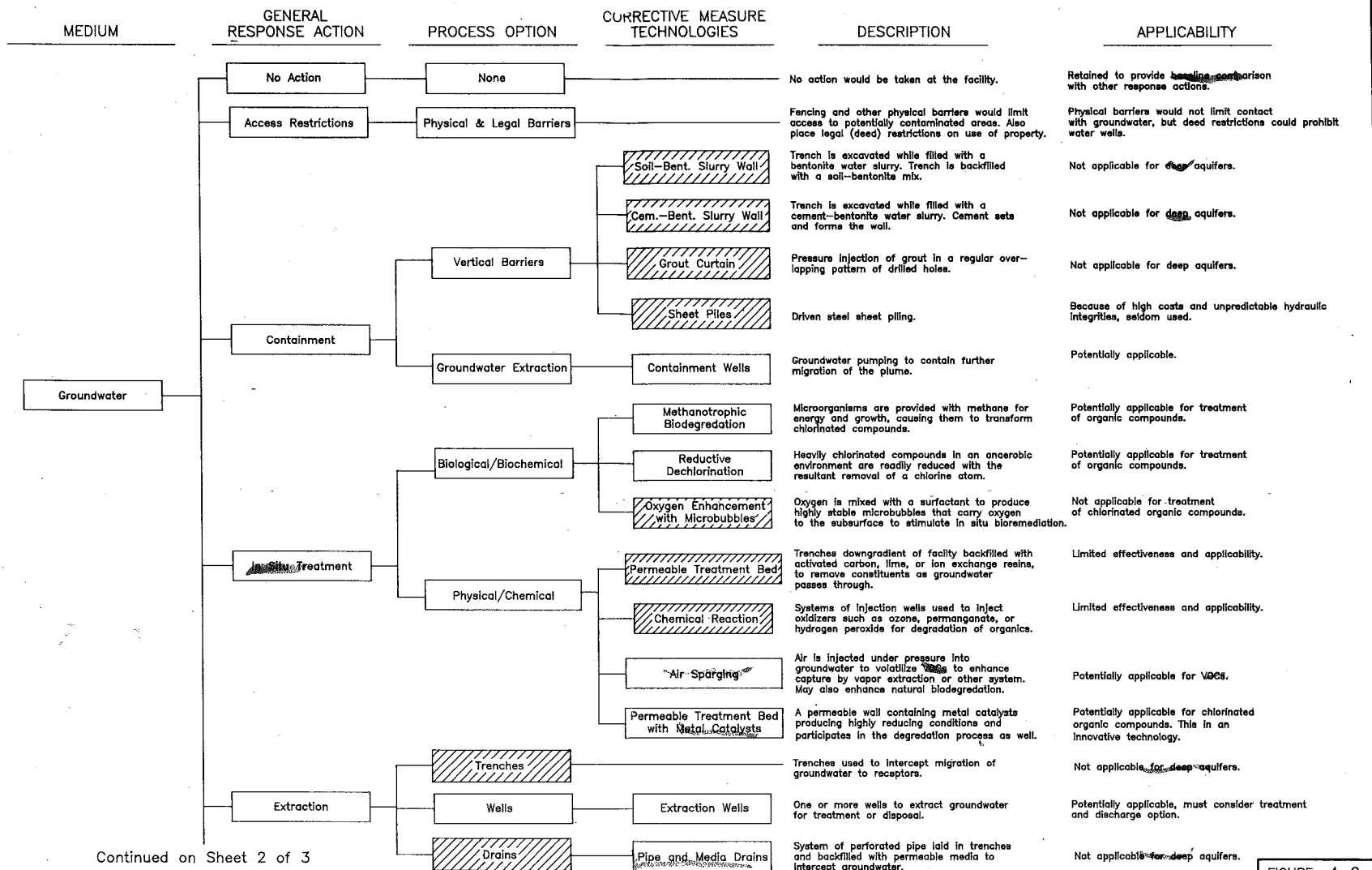


Three Hawthorn Parkway
Vernon Hills, Illinois
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TECHNOLOGY SCREENING for
GROUNDWATER TREATMENT - Sheet 2 of 3
TECHALLOY COMPANY, INC.
Union, Illinois

FIGURE 4-2

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LEGEND



Technology screened out

Continued on Sheet 2 of 3



Three Hawthorn Parkway
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FIGURE 4-2

TECHNOLOGY SCREENING for
GROUNDWATER TREATMENT - Sheet 1 of 3
TECHALLOY COMPANY, INC.
Union, Illinois

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4.4 GROUNDWATER REMEDIATION

The main categories of general response to chemical constituents in groundwater are as follows:

- No action, which provides a baseline for comparison against other alternatives.
- Use and/or access restrictions, which can prohibit use of water wells.
- Containment, which prevents further migration of constituents in the groundwater.
- Extraction, which involves removal of groundwater for treatment or disposal.
- Treatment, which encompasses treatment in situ, on site, and off site.
- Discharge, with or without treatment.
- Monitoring, using groundwater monitoring wells.

This evaluation identifies process options and representative technologies for each general response action. Where possible, this evaluation encompasses innovative technologies (e.g., air sparging, permeable treatment bed with metal catalysts, in situ bioremediation). The technologies are screened to eliminate those that are inappropriate or not applicable for further consideration for the Techalloy facility. The elimination of technologies is based on available analytical data and information about the potential release of chemical constituents from the SWMUs to groundwater at the facility. Figure 4-2 provides the detailed technology screening for groundwater. As indicated in the figure, several technologies have been eliminated from future consideration. These include sheet piles, steam stripping, permeable treatment bed, chemical reaction, supercritical extraction, reduction, incineration, treatment at a Publicly-Owned Treatment Works (POTW), and deep

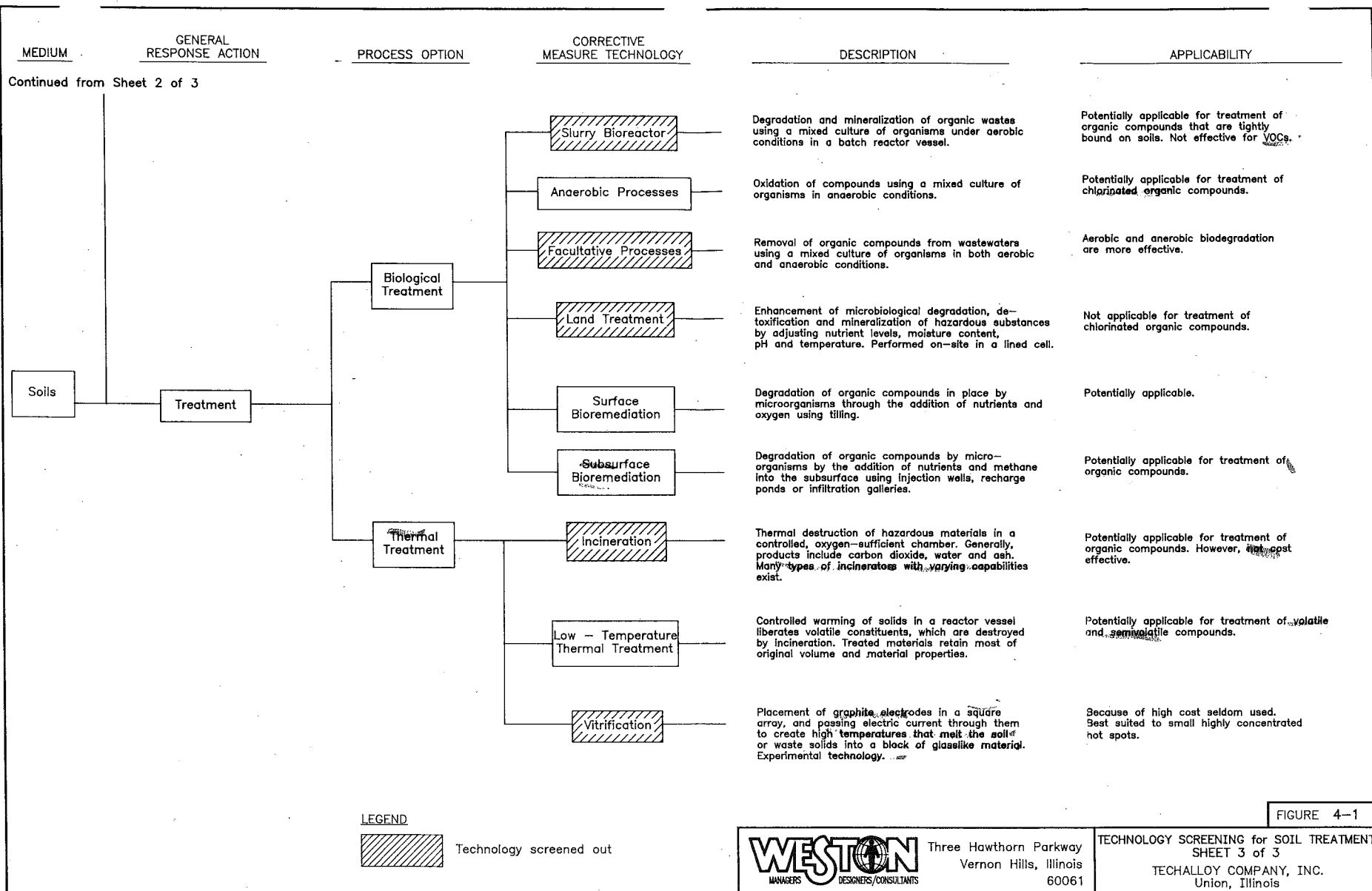
Table 4-2

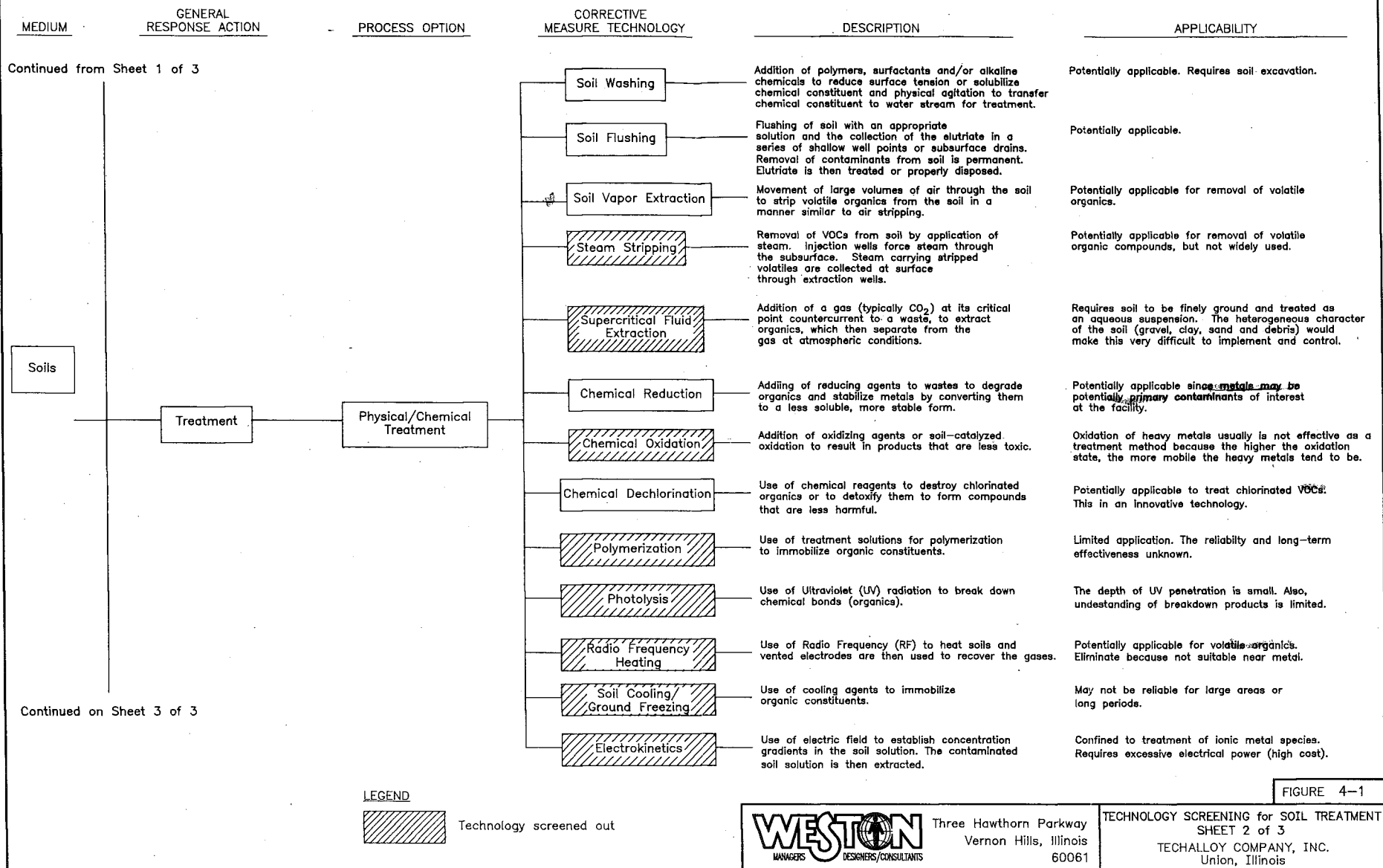
**Summary of Potentially Applicable Corrective Measure
 Technologies for Soil
 Techalloy Company, Inc.
 Union, Illinois**

Response Action	Process Option	Corrective Measure Technology
No Action	None	None
Access Restriction	Physical and legal restrictions	Restrict property use and/or fencing
Containment	Soil cover caps	Native soil Single layer cap Double layer cap
Removal	Excavation	Excavation Disposal
Disposal	Landfill	Off-site RCRA landfill Sanitary landfill
Treatment	Solidification/stabilization	Using pozzolanic agents Thermoplastic microencapsulation
	Physical/chemical treatment	Soil washing/flushing Soil vapor extraction Chemical reduction Chemical dechlorination
	Biological	Surface bioremediation Anaerobic processes Subsurface bioremediation
	Thermal	Low-temperature thermal treatment

- No action, which provides a baseline for comparison against other alternatives.
- Access restrictions, which use physical and legal barriers to discourage contact with constituents.
- Containment, which physically controls the constituents that may be present in the facility soils.
- Removal, which transports media affected by the constituents for treatment or disposal.
- Disposal, which removes media with or without treatment.
- Treatment, which alters chemical constituents to less harmful forms prior to disposal.

For each general response action listed above, the evaluation develops a number of potentially feasible corrective measure process options. For each process option, the evaluation identifies at least one potentially feasible technology. Where possible, the evaluation considers innovative technologies (e.g., soil washing, supercritical fluid extraction, steam stripping, vitrification, and bioremediation). The technologies are screened according to their usefulness at the Techalloy facility. The screening eliminates those technologies that cannot be implemented technically at the facility. The elimination of technologies is based on available analytical data and information about the chemical constituents that may be present in the facility soils. Figure 4-1 provides the detailed technology screening for soil. As indicated in this figure, the following technologies have been eliminated from further consideration: sorption, steam stripping, supercritical fluid extraction, chemical oxidation, radio-frequency heating, polymerization, photolysis, soil cooling/ground freezing, electrokinetics, slurry bioreactor, facultative processes, land treatment, incineration, and vitrification. Table 4-2 summarizes the applicable corrective measure technologies for chemical constituents that may be potentially present in the soils.





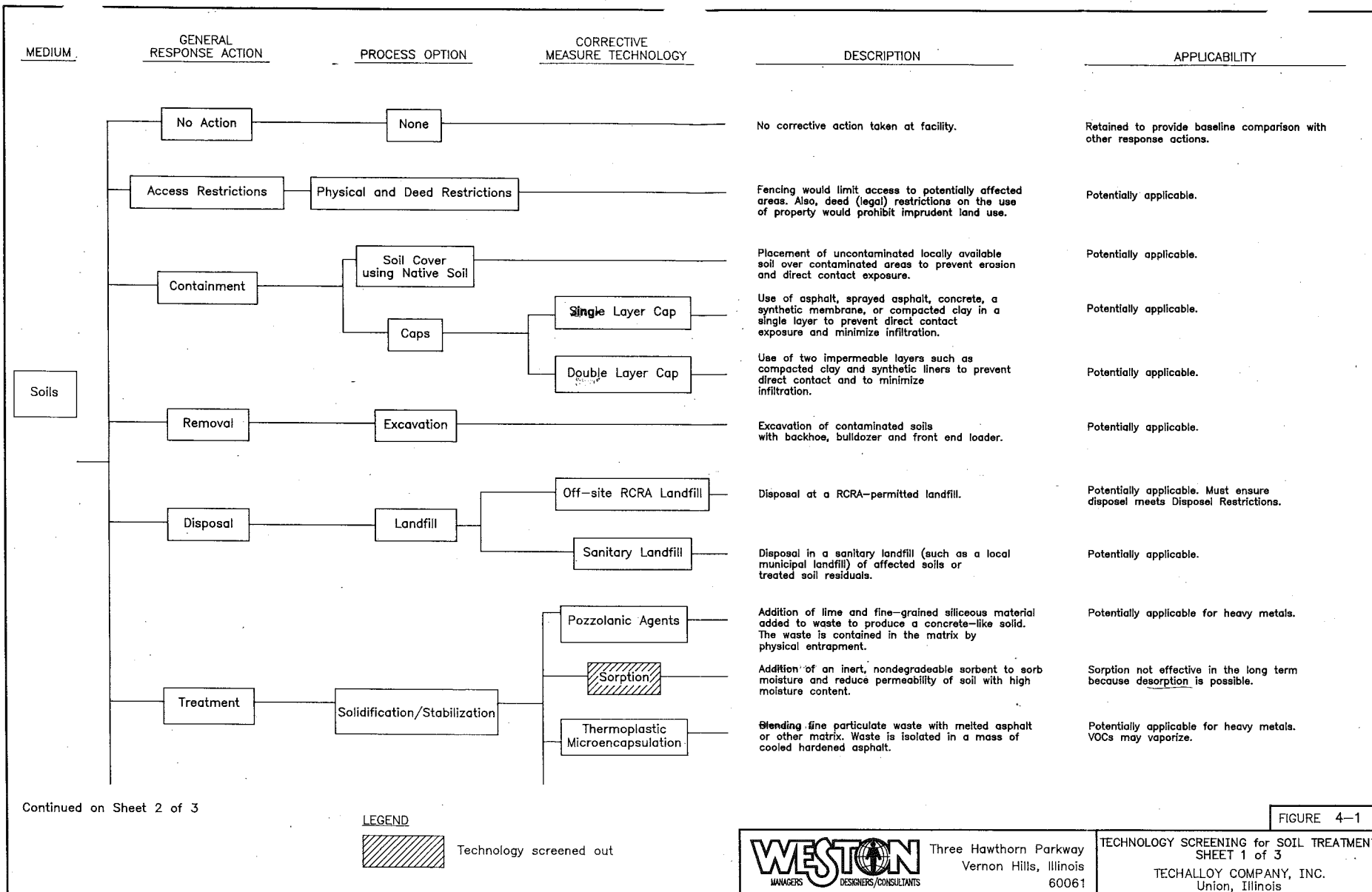


Table 4-1

**Waste Characteristics
 Techalloy Company, Inc.
 Union, Illinois**

Sources/Migration Pathways Addressed by the RFI	Suspected Constituents	Current Status
Sources (soils)		
Wire Slag Disposal Area	VOCs, metals.	Actively used as a forklift driveway and a dumpster holding area for a single dumpster. The dumpster contains only solids. The area is paved to prevent infiltration.
BG-5 Drum Storage Area	VOCs, metals.	Inactive. Used to store discarded containers unrelated to BG-5.
Concrete Evaporation Pad	VOCs (primarily PCE and 1,1,1-TCA), metals.	Inactive since 1978. Soil may harbor residual constituents serving as continuing source.
Spent Acid Holding Pond (also known as Settling Pond)	VOCs, metals.	Inactive since 1980.
Plating Wastewater Disposal Area	VOCs, metals, cyanide.	Inactive since 1979.
Migration Pathways		
Groundwater	VOCs both on and off site (primarily, 1,1,1-TCA, TCE, and PCE), metals (on site).	The potential receptors are restricted to residential water wells. Several present and former community wells are nearby, but they are not receptors.

Based on the results of the RCRA Facility Investigation ... the Owner ... shall identify, screen and develop the alternative or alternatives for removal, containment, treatment and/or other remediation of the contamination based on the objectives established for the corrective action. (U.S. EPA, 1988, p. 17, emphasis added.)

The RFI for the Techalloy facility is presently in its planning stage. According to the U.S. EPA guidance, a project at Techalloy RFI's stage of development should evaluate technologies, but not alternatives. Consequently, this section concludes with the evaluation of technologies.

4.2 TECHNICAL APPROACH

The technical approach conforms with the U.S. EPA's RCRA guidance. Potentially feasible corrective measure technologies for remediation at the Techalloy facility were identified by evaluating the currently known facility conditions and waste characteristics. Table 4-1 describes the suspected constituents in soils and groundwater. While the RFI generally treats the Techalloy facility as several solid waste management units (SWMUs), the pre-investigation technology screening views the facility as a whole. The SWMU-based approach would be preferable, but insufficient data are available to use this approach in the pre-investigation screening. After the SWMU characterization has been confirmed by the RFI, subsequent assembly and screening of alternatives is likely to show that certain technologies may be appropriate for some SWMUs but not for others. Thus, each potentially feasible corrective technology may be applied to one or all of the SWMUs, or several corrective technologies may be applied in combination for remediation of a single SWMU.

4.3 SOIL REMEDIATION

The main categories of general response to chemical constituents in soils are:

SECTION 4

PRE-INVESTIGATION EVALUATION OF CORRECTIVE MEASURE TECHNOLOGIES

This section provides a preliminary evaluation of potential corrective measure technologies for the Techalloy facility. The pre-investigation screening of technologies benefits the RFI in several ways. First, the early determination of potentially feasible corrective measure technologies helps to define the goals of the RFI. Second, the preliminary evaluation identifies investigative tasks that address data gaps that must be filled to assess the potentially feasible technologies. Third, the preliminary evaluation saves time and resources by focusing effort where study is likely to yield the greatest practical benefit.

4.1 SCOPE OF THE PRE-INVESTIGATION EVALUATION

The scope of this pre-investigation evaluation of corrective measure technologies conforms with the U.S. EPA guidelines in the RCRA Corrective Action Plan (U.S. EPA, 1988). U.S. EPA's RCRA guidance requires early technology identification in the planning documents of the RFI and, if warranted, subsequent assembly and evaluation of alternatives in a Corrective Measures Study (CMS) after the RFI is complete. RCRA guidance explains that technology identification precedes the RFI:

Prior to starting the facility investigation, the Owner ... shall submit to [U.S.] EPA a report that identifies the potential corrective measure technologies that may be used on-site or off-site for the containment, treatment, remediation, and/or disposal of contamination. (U.S. EPA, 1988, p. 6).

RCRA guidance calls for development and screening of alternatives in a CMS, after the RFI is complete:

SECTION 5

PROJECT MANAGEMENT PLAN

This section presents the objectives of the RFI and the general scope and rationale of the investigative activities. The overall project management approach and key personnel are presented along with a schedule of performance of the RFI activities.

5.1 RFI OBJECTIVES

WESTON has developed a technical approach that satisfies the objectives specified in the U.S. EPA "RCRA Corrective Action Plan (OSWER Directive 9902)" and the "RCRA Facility Investigation Guidance Document (OSWER Directive 9502)." The RFI has the following objectives:

- Assess potential releases from the solid waste management units (SWMUs).
- Determine the vertical and horizontal extent and magnitude of constituents in the source area(s).
- Determine the vertical and lateral extent and magnitude of constituent migration in groundwater.
- Identify potential receptors of hazardous constituents migrating off site.
- Screen and evaluate appropriate remedial alternatives.

The extent of constituent migration in groundwater was addressed in previous work at the site (i.e., "Phase II Soil and Groundwater Investigation" June, 1991). The following work scope is designed to provide the additional data and documentation which U.S. EPA requires to fulfill the current Consent Order guidelines.

5.2 FACILITY INVESTIGATION

In accordance with the RCRA guidelines and to address the existing data gaps, the work scope has been organized into six tasks:

- Source characterization.
- Pathway characterization.
- Extent of constituent characterization.
- Potential receptors.
- Analytical program.
- RFI report.

The rationale for the RFI activities associated with each of these tasks is discussed in this subsection. The Techalloy RFI activities will be performed in two phases. The following discussions identify the activities associated with each task to be performed during each of these phases. The objectives for the Phase I and Phase II activities are presented in Table 5-1. The data needs related to these objectives are summarized in Table 5-2.

5.2.1 Source Characterization

The source characterization activities will involve subsurface soil sampling and groundwater sampling in five specific areas. These five areas are near the following five SWMUs identified in the U.S. EPA consent order:

- Wire Slag Disposal Area.
- BG-5 Drum Storage Areas.
- Spent Acid Holding Pond.
- Plating Wastewater Disposal Area.

Table 5-1
Objectives of Facility Investigation
Techalloy Company, Inc.
Union, Illinois

Objectives	Task	Activity	Purpose
Phase I			
Source Characterization	Sample soil.	Logging of soils. Sample collection/analysis.	Define media. Determine existing concentrations and extent of constituents.
Pathway Characterization	Sample groundwater.	Sample collection/analysis.	Determine vertical extent of constituents at individual SWMUs.
	Confirm groundwater flow conditions on and off site.	Monitoring well water level measurements.	Confirm groundwater migration flow path on and off site.
Extent of Volatile Constituent Migration	Collect groundwater samples downgradient of suspect source area, on and off site.	Groundwater samples from on- and off-site monitoring wells.	Confirm existing level and extent of constituents in groundwater. Aid in potential placement of additional monitoring wells.
Phase II			
Source Characterization	Sample soil.	Logging of soils. Sample collection/analysis.	If extent not fully determined under Phase I, Phase II will define media and determine existing concentrations and extent of constituents.
Pathway Characterization	Completed under Phase I.		
Extent of Volatile Constituent Migration	Completed under Phase I.		

Table 5-2

RFI Objectives and Data Needs
Techalloy Company, Inc.
Union, Illinois

Objective	Data Need
Source Characterization	
Soil and groundwater sampling	Laboratory analysis of soil and groundwater samples from soil borings for VOCs, SVOCs, metals, and inorganic analysis
Pathway Characterization	
Groundwater flow direction	Groundwater level elevations from on-site and off-site monitoring wells
Extent of Constituent Migration	
Monitoring well sampling and analysis	Laboratory analysis of groundwater samples from a minimum of 13 and a maximum of 15 monitoring wells for VOCs, metals and inorganics. Laboratory analysis of groundwater samples from some monitoring wells for SVOCs.
Soil sampling and analysis	Laboratory analysis of 75 subsurface soil samples from 42 locations

- Concrete Evaporation Pad.

The locations of these five units are depicted in Figure 5-1.

Source characterization activities will determine the actual contribution of chemical constituents to the surrounding soil and groundwater at each of the SWMUs in question.

Soil Borings

The Phase I source characterization activities will include the advancement of soil borings in a grid pattern around each SWMU area. The borings will be advanced through the ~~vadose zone~~ soils to determine the presence, nature, magnitude, and lateral and vertical extent of constituents potentially related to each SWMU in question. The borings will be advanced above the water table which lies at approximately 9 feet below ground surface (bgs). Split-spoon samples will be collected to allow visual classification of the soils. Two soil samples will be collected for laboratory analysis from each boring location. The samples will be collected from 1 to 2 feet bgs and 5 to 6 feet bgs. The shallow soil sample will be collected 1 foot below the native soil surface in areas where surficial fill is present, and the deeper soil sample will be collected above the capillary fringe of the water table.

Groundwater

At least one groundwater sample will be collected directly below or on the downgradient side of each SWMU. One soil boring will be advanced below the water table to allow for collection and analysis of a shallow groundwater sample. This analysis will determine if constituents related to each SWMU in question have migrated vertically to the groundwater table.

Background Sampling

Six soil borings will be advanced upgradient, southeast of the facility. Six soil samples and six groundwater samples will be collected for analyses to determine background concentrations of constituents indigenous to the area. Background levels will be compared statistically with concentrations detected on site to determine the significance of the on-site occurrence.

Sample Analyses

All soil and groundwater samples will be analyzed for those constituents potentially associated with the SWMU being investigated. This will determine if a release to the environment has occurred and, if so, the nature, magnitude, and extent of the release. In general, samples will be analyzed for VOCs, metals, and in some cases, cyanide as historical information points only to those three classes of analytes. Selected soil and groundwater samples will also be analyzed for SVOCs to determine whether they are present in the vicinity of SWMUs and downgradient groundwater. The sampling program is summarized in Table 5-3. The specific sampling locations and details with regard to procedures are presented in the Quality Assurance Project Plan.

If the Phase I soil sampling and analysis results do not define the horizontal and/or vertical extent of constituents potentially released from any of the SWMUs in question, additional soil sampling locations will be identified and sampled under a Phase II effort.

5.2.2 Pathway Characterization

Based on the available information gathered to date at the Techalloy site, groundwater is the primary migration pathway for volatile organic constituents (VOCs) at and away from the site. Concentrations of chemical constituents in surface water and sediments are not pathways of concern, since the nearest body of surface water is 1/2 mile northeast of the site. Direct surface runoff of constituents is not a pathway of concern because precipitation infiltrates into permeable site soils due to minimal relief, and because ditches and drainage

ways do not discharge off site. In addition, constituent concentrations are limited to subsurface soils in a relatively flat area where erosion and surface transport of these constituents are unlikely. Air is not a pathway of concern based on previous investigative activities and associated personnel health and safety air monitoring results. In addition, no extrusive activities that would release VOCs to the air are planned for the investigation.

VOCs are known to be migrating in groundwater at and downgradient of the site. Spent TCA solvent previously treated on the concrete evaporation pad has infiltrated the soil and percolated to the water table. Upon reaching the water table, the constituents have moved downgradient (northwestward) with groundwater.

The "Phase II Soil and Groundwater Investigation" report, dated June 1991, summarized the lateral and vertical extent of the downgradient VOC migration in the groundwater. Therefore, pathway characterization under Phase I of the RFI will be limited to the measuring of water levels and sampling the existing monitoring wells.

Water Table Elevations

The recording of water table elevations in on- and off-site monitoring wells will be performed to confirm the current groundwater flow direction. The reference point for these elevations will be the top of the casing of the well. The elevation of the top of the casing will be established relative to mean sea level (MSL) in a field survey conducted during the RFI.

Survey

The field survey will be performed by a licensed land surveyor. The elevations of the well casings will be tied to the nearest national geodetic datum. The survey will also generate a scale map of the facility and the surrounding area.

Monitoring Well Sampling

Existing monitoring wells will be sampled for VOCs and metals analysis to establish the current distribution of constituents in on- and off-site groundwater (Table 5-3). Based on the Phase I RFI results, additional monitoring wells may be installed and sampled under a Phase II effort to fill any data gaps that may exist.

Aquifer Testing

In conjunction with the implementation of the interim measures at the Techalloy site, an aquifer pumping test will be performed to determine hydraulic conductivity, transmissivity, and storativity of the aquifer. Geotechnical analysis of the aquifer will also be performed to determine grain size distribution and effective porosity. This approach to pathway characterization will provide the data necessary for design of the interim measures groundwater extraction system. Consistent with the U.S. EPA's Consent Order, the scope of work for the interim measures activities has been addressed in the "Interim Measures Work Plan," dated March 1993.

5.2.3 Extent of Constituent Characterization

The horizontal and vertical extent of constituent migration in soil near each of the SWMUs will be determined during the Phase I activities, as described in Subsection 5.2.1. If the full extent is not defined, additional soil sampling will be conducted under Phase II of the RFI.

The horizontal and vertical extent of constituents in both on- and off-site groundwater has been determined ("Phase II Soil and Groundwater Investigation," June, 1991). The existing monitoring wells on and off site will be sampled ~~under Phase I of the RFI~~ to establish the current distribution of constituents in the groundwater. An additional groundwater sample will be collected near off-site SW-21 and analyzed for VOCs to verify the downgradient extent of contamination.

Under a Phase II effort, additional on- or off-site monitoring wells may be installed and sampled if deemed necessary based on the Phase I analytical results.

5.2.4 Potential Receptors

Consistent with U.S. EPA's Consent Order, the identification of potential receptors of constituents originating at the Techalloy facility has been addressed in the "Private Well Sampling Plan" (PWSP) dated February 1993. Twelve potential receptors of constituents migrating off site in the groundwater have been identified. Table 2-12A lists the owners and addresses of the 12 residential wells located and sampled. The sampling and analysis procedures for these seven locations are presented in the PWSP. Sampling and analysis will identify potential exposure points to the human population.

5.2.4.1 Ecological Assessment

A screening-level ecological assessment, which utilizes data from the site investigation, information from the open literature, and relevant benchmark values, will be used to

qualitatively determine whether it can be safely assumed that site chemicals pose no threat to ecological receptors. This ecological evaluation will be organized into the following components:

- Site characterization.
- Exposure assessment.
- Toxicity Screening.

Site Characterization

In characterizing the site, data on the environmental systems that are susceptible to chemical exposure from the facility will be collected. Habitats on and adjacent to the facility will be identified and described, including an evaluation of any old-field or edge habitats present on the property and the use of standing water birds. Plant and animal species inhabiting the facility and adjacent properties will also be identified and described. Any known or observed adverse effects (e.g., stressed vegetation, bird carcasses, or other obvious impacts) of site chemicals on ecological receptors will be identified. Such information will be obtained from facility employees, other local observers, previous WESTON site visits, the literature, and available maps (e.g., National Wetlands Inventory maps) and aerial photographs. The U.S. Fish and Wildlife Service (Chicago Field Office) will be contacted to confirm that the following Federally listed or proposed endangered or threatened species are not present at or near the facility: bald eagle, Indiana bat, and prairie bush clover. Written confirmation from the USFWS will be included in the RFI submittal.

Exposure Assessment

In general, an ecological exposure assessment evaluates the potential magnitude and frequency by which ecological receptors and/or communities are exposed to chemicals of potential concern. A conceptual exposure model will be developed for the facility. This conceptual model integrates and summarizes the information concerning impacted media,

chemical migration pathways, and exposure routes into a combination of exposure pathways for the terrestrial and aquatic receptors present at the site.

Toxicity Screening

The toxicological properties of site, including an evaluation of each chemical's potential to bioaccumulate. Scientific literature and regulatory guidelines will be reviewed for media-specific and/or species-specific toxicity data. Sources of toxicity data include:

- Ambient Water Quality Criteria (U.S. EPA).
- Sediment Biological Effect Levels (NOAA).
- Aquatic Information Retrieval (AQUIRE).
- Integrated Risk Information System (IRIS).
- Hazardous Substance Data Base (HSDB).
- Contaminant Hazard Reviews (USFWS).
- Toxicological Profiles (ATSDR).
- PHYTOTOX database.

A qualitative determination of the potential impacts of chemicals from the facility on plants and animals will be made through an evaluation of the information gathered in the site characterization, exposure assessment, and toxicity screening.

5.2.5 Analytical Program

Upon completion of field activities and receipt of analytical results, all data will be compiled to assess on- and off-site conditions. All laboratory chemical data will be validated internally by WESTON personnel.

A summary of the chemical analyses to be performed is presented in Table 5-3. Analyses will be performed following U.S. EPA SW-846 methodologies (Table 5-4).

Analytical results will be compared statistically to background levels where appropriate to establish the nature of the constituents detected. Detected concentrations in soils will be compared to the on-site cleanup objectives (CUO) issued to Techalloy by IEPA in July 1990 to establish the potential need for a future remedy. Detected concentrations in groundwater will be compared to maximum contaminant levels (MCLs) to establish the need for and type of potential remedy.

5.2.6 RFI Report

Upon completion of the RFI activities and analyses of all data generated, a draft final RFI report will be submitted to the U.S. EPA for review and comment. Upon incorporation of EPA comments and revisions, a final RFI report will be submitted to U.S. EPA.

5.3 MANAGEMENT APPROACH

WESTON intends to manage this project to allow a maximum amount of flexibility in investigation and assessment. This approach will allow the most rapid and cost-effective performance of the RFI/CMS by allowing modification of the investigation based on field conditions.

Although the project scope is defined earlier in Section 5, WESTON recognizes the importance of field observations and modifications. Open communication will be maintained between the management and field personnel. When field observations indicate that a change in scope or methodology may be appropriate, Techalloy and WESTON will initiate discussions with U.S. EPA concerning the proposed change. If verbal approval is

Table 5-4

Analytical Methods for
Soil/Groundwater
Techalloy Company, Inc.
Union, Illinois

Parameter	Method Number(s)
Volatile organic compounds (VOCs)	SW 846, Method 8240
Semivolatile organic compounds (SVOCs)	SW 846, Method 8270
RCRA metals	ICP SW846, Method 6010 except: arsenic - SW 846, Method 7060 Selenium - SW 846, Method 7740
Cyanide	EPA Method 335.2

secured, WESTON will modify its field activities and will confirm the change by issuing a work plan amendment in letter form in a timely fashion.

5.3.1 Project Organization

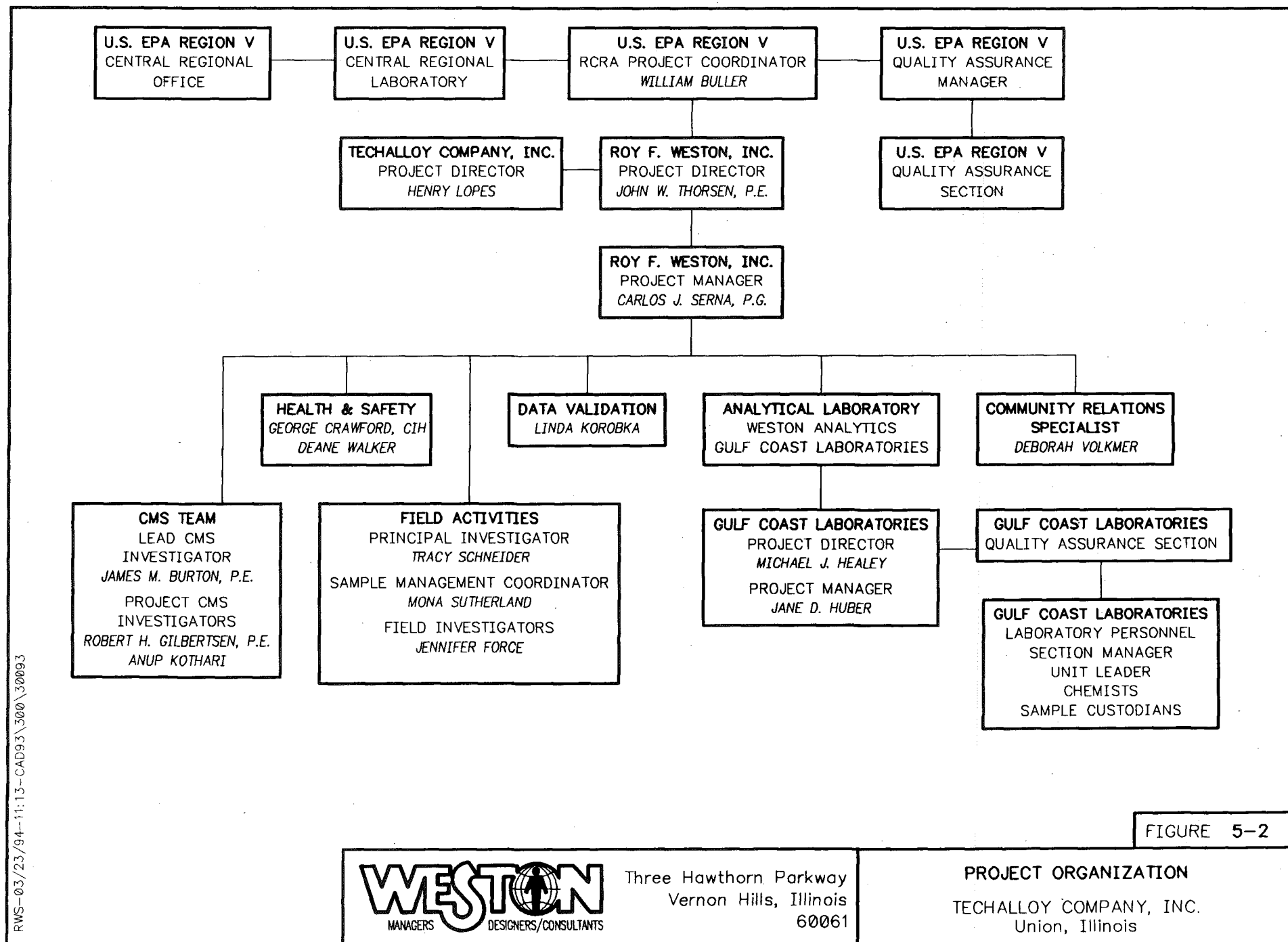
The proposed project organization is shown in Figure 5-2 and in Section 3 of the QAPP. In general, the organization includes management personnel who will be responsible for communication with project and U.S. EPA personnel, technical direction of the project, and preparation of deliverables; advisory personnel who will review project quality assurance and health and safety issues; RFI team personnel who will perform data measurement, sample collection, and well installation, and will be responsible for complying with the Quality Assurance Plan, relaying critical field observations to management; data validation personnel who will review and validate chemical data; a CMS team who will perform the assessment of corrective measures; and a community relations team who will keep members of the community(s) informed of the activities at the site and will assist Techalloy and U.S. EPA in anticipating and responding to community concerns.

Additional qualified personnel are available within WESTON in the fields of chemistry, risk assessment/toxicology, community relations, and chemical engineering, if needed for special site conditions.

5.3.2 Project Management

Techalloy Project Director - Mr. Henry Lopes. The Techalloy Project Director has overall responsibility for the success of this project in meeting Techalloy's corporate objective of full compliance with both the letter and spirit of corrective action requirements. The Techalloy Project Director ensures constructive two-way communication between project participants

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and agency personnel, as well as communication and coordination with Techalloy officers and ownership in approvals of scope, schedule, and budget for the project.

WESTON Project Director - Mr. John W. Thorsen, P.E. The WESTON Project Director is responsible for ensuring all the required resources are available to successfully complete the project. Further, he has ultimate responsibility for conformance to budget and schedule, and project deliverable quality. Mr. Thorsen has 21 years of environmental engineering experience, with 15 years in hazardous waste management. Mr. Thorsen has overseen seven RFI/CMS projects.

WESTON Project Manager - Mr. Carlos J. Serna, P.G. The WESTON Project Manager will be responsible for the day-to-day coordination of WESTON's activities. In that capacity, he will be responsible for meeting deadlines and ensuring that the project is executed on schedule and within the agreed-upon budget. During active phases of work he will maintain daily contact with project personnel to ensure technical quality and efficient use of WESTON's resources.

Mr. Serna has an M.S. in hydrogeology and has been an environmental consultant since 1985. He has served as Principal Investigator on several large soil and groundwater investigations, including CERCLA and RCRA projects. He is currently managing two projects which include the preparation and implementation of RFI/CMS and the implementation of interim measures at one of those facilities.

5.3.3 WESTON Advisory Staff

Corporate Health and Safety Coordinator - Mr. George Crawford. The Health and Safety Coordinator will be responsible for final approval of the Site Health and Safety Plan. He will ensure compliance with appropriate health and safety rules, policies, and procedures.

Mr. Crawford has over 20 years of experience in health, safety, industrial hygiene, and hazardous materials response and management.

Regional Health and Safety Officer - Mr. Deane Walker. The Regional Health and Safety Officer will be responsible for preparing and updating the Site Health and Safety Plan. He will be available to advise in case of site-related incidences or unanticipated health and safety issues. Mr. Walker has over 5 years of experience in health, safety, industrial hygiene, and hazardous materials response and management.

5.3.4 RFI Team

Field Activities

The RFI field team will be comprised of individual geologists and small sampling teams. The geologists will be responsible for directing drilling and well installation; enforcing the Health and Safety and Quality Assurance Plans for these activities; documenting these activities in the form of field notes, trip reports, boring logs, and photographs; and communicating with the WESTON Project Manager. All of WESTON's field personnel are trained and medically monitored in accordance with OSHA requirements.

The sampling teams will consist of a team leader and one or two sampling technicians. The team leader will be responsible for final selection of sampling locations; sample custody; enforcing the Health and Safety and Quality Assurance Plans for these activities; documentation of these activities in the form of field notes, trip reports, and photographs; and communication with the WESTON office. The project manager will designate the sampling team leader for each sampling event.

When a sampling crew is present on site, the sampling team leader will function as the site coordinator. The site coordinator will be responsible for communication with EPA during site visits.

Personnel involved in field activities will include:

Geologist/Principal Investigator - Ms. Tracy Schneider. Ms. Harding has more than 2 years of experience in site investigations with the majority of her experience on RFIs. Ms. Harding has directed a large variety of investigative and sampling tasks and assisted in work plan and final report preparation.

Geologist - Ms. Jennifer Force. Ms. Force has more than 1 year of experience in site investigations and sample collection, including groundwater, surface water, and soil samples. She is experienced with installing groundwater monitoring wells, piezometers, and soil borings.

Sample Management Coordinator - Ms. Mona Sutherland. Ms. Sutherland has over 4 years experience as an engineer with experience in hazardous waste engineering. She has experience working on RI/FSs at Superfund sites sponsored by U.S. EPA.

Data Analysis

The data analysis team will include those individuals above, plus personnel involved in validation of chemical data.

Data Validation Coordinator - Ms. Linda Korobka. The Data Validation Coordinator will be responsible for establishing validation procedures and ensuring that all data are validated. Ms. Korobka has over 6 years of environmental laboratory experience in quality assurance, operations management, communications and analytical chemistry including inorganic chemistry, wet chemistry, Flame AA, Furnace AA, and ICP. Ms. Korobka will be assisted by staff chemists.

5.3.5 CMS Team

CMS Coordinator - Mr. James M. Burton, P.E. The CMS Coordinator will organize and supervise the CMS effort and will provide the technical insight required for identification and screening of alternatives. Mr. Burton is a registered P.E. and has 8 years of experience in various aspects of hazardous waste remedial investigations and feasibility studies. Major work items include preparation for sampling and analysis plans, health and safety plans, quality assurance plans, work plans (technical proposal and cost estimate); remedial investigation reports; and feasibility studies. Mr. Burton will be assisted by staff engineers.

Project Engineer - Robert H. Gilbertsen, P.E. Mr. Gilbertsen holds B.S. and M.S. degrees in civil engineering. He is a registered professional engineer with over 4 years of environmental engineering experience, which includes conducting remedial investigations and feasibility studies. Mr. Gilbertsen's primary responsibility on this project will be assisting with the preparation of planning and report documents.

Assistant Engineer - Mr. Anup Kothari. Mr. Kothari holds B.S. and M.S. degrees in chemical engineering. He has over 2 years of experience in environmental engineering projects including feasibility studies, site investigations and data collection, and conceptual design of solid and hazardous waste remediation systems.

5.3.6 Community Relations Team

Community Relations Coordinator - Ms. Deborah E. Volkmer. Ms. Volkmer has over 14 years of public relations experience. Ms. Volkmer has been a consultant to the U.S. EPA in two regions for public and community relations projects for a variety of hazardous waste sites and environmental concerns.

5.4 PROPOSED SUBCONTRACTORS

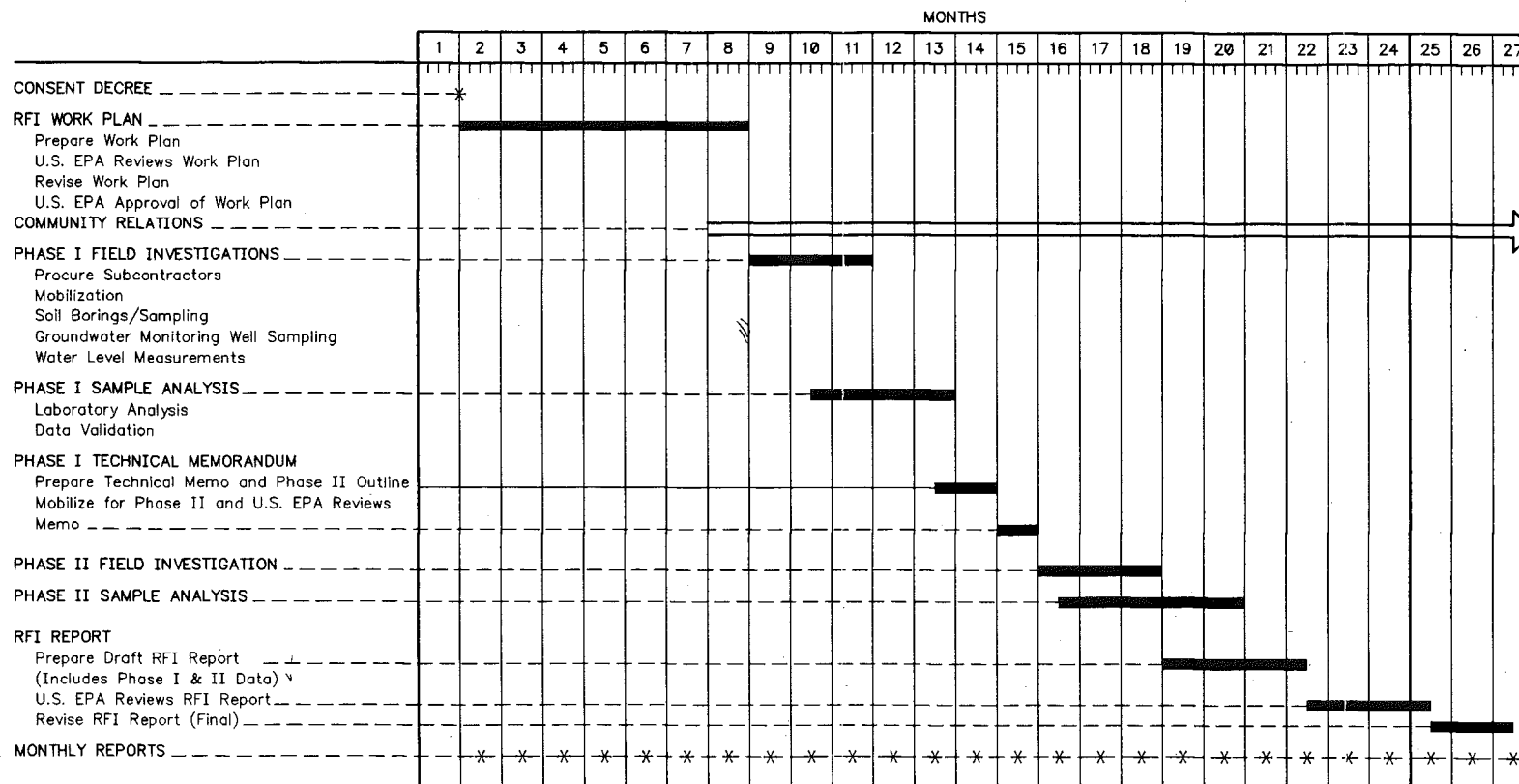
WESTON-Gulf Coast Laboratories, Inc. (Gulf Coast) is proposed as the analytical subcontractor. Gulf Coast is capable of performing virtually all types of chemical analysis. Their standard operating procedures for Gulf Coast are presented in Appendix B of the QAPP.

The drilling subcontractor has not yet been selected, but will be chosen during mobilization. The subcontractor selected must provide personnel who are trained in handling of hazardous wastes, monitored under a medical monitoring program, and experienced in environmental investigations and monitoring well installation. When the subcontractor is chosen, U.S. EPA will be notified and provided with qualifications.

5.5 SCHEDULE

Figure 5-3 presents the RFI project schedule. According to the Consent Order, the RFI Work Plan should be submitted within 90 days of the effective date of the Consent Order. The RFI Work Plan is subject to approval by the U.S. EPA. The duration of document review is at the Agency's discretion. For purposes of this schedule, WESTON has assumed two months for the first review. Within 30 days of receipt of the U.S. EPA's comments, WESTON will amend the documents, make the changes required by the U.S. EPA, and will resubmit the documents to the U.S. EPA. The duration of the second review is also at the Agency's discretion. For purposes of this schedule, WESTON has assumed one month for the second review and approval. Within 30 days of U.S. EPA's approval of the Work Plan, WESTON will start the Phase I field investigation. Figure 5-3 presents the schedule for Phase I investigations, Phase I sample analyses, and the Phase I technical memorandum. The Phase I technical memorandum will identify any investigation data gaps/limitations and will contain a Phase II investigation outline. The Phase II outline will include additional activities to fill any identified data gaps. The Phase II outline will be presented to U.S. EPA in a meeting. It is expected that an agreement to the Phase II scope of work will be completed during the meeting, and Phase II activities will then commence within one month. Phase II activities are contingent upon the results of Phase I activities. The direction of the Phase II investigation cannot currently be defined; however, it is believed that a three-month timeframe will be sufficient. This assumes no off-site activities are needed which may require access agreements. It should be noted that no agency review time is included for the Phase II outline. Should the agency require additional review time beyond the meeting, the schedule will be prolonged accordingly. As presented in Figure 5-3, the draft RFI report will be submitted to the U.S. EPA approximately 400 days following the approval of this work plan and will include Phase II results.

This schedule is based on the scope of work presented in this Work Plan. The schedule will be revised to reflect any change of scope. The schedule will also be updated to reflect the Agency's actual review time(s). The Phase II activities are contingent upon the results of the Phase I activities. The actual duration of the Phase II investigation will be presented in the Phase I technical memorandum. The project schedule will be updated and submitted with the monthly progress reports, along with a discussion of any actual or anticipated delays.



- NOTES: (1) The duration of document review is at the Agency's discretion. For purposes of this schedule, WESTON has assumed two months for the first review and one month for the second review and approval. The schedule will be updated to reflect the Agency's actual review time.
- (2) The Phase II activities are contingent upon the results of the Phase I activities. The duration of the Phase II investigation can not currently be defined.

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Three Hawthorn Parkway
Vernon Hills, Illinois
60061

RFI PROJECT SCHEDULE
TECHALLOY COMPANY, INC.
Union, Illinois

FIGURE 5-3

SECTION 6

DATA MANAGEMENT PLAN

6.1 INTRODUCTION

The objective of a Data Management Plan (DMP) is to establish procedures for documenting, tracking, and presenting investigative data. Data generated in support of the Techalloy site, as well as existing data, will be used to form the basis for conclusions regarding the RFI and recommendations for remediation as presented in the CMS. Efficient and comprehensive consideration of all available data requires that these data be properly organized. Organization of the data must be planned prior to actual collection to ensure the generation of appropriate and usable data. Procedures must also be provided prior to data collection for efficient validation and transfer to a system from which the data can be evaluated with minimal effort. This plan describes the operating practices to be followed by WESTON personnel during the collection and reporting of data. The DMP will be implemented during all phases of the Techalloy RFI.

The DMP is considered to be a companion document to the Quality Assurance Project Plan (QAPP), and as such, cannot be implemented independent of the QAPP. The data quality objectives (DQOs) quality assurance/quality control (QA/QC) field and analytical procedural requirements and other reporting practices that are relevant to and/or affect project data are specified in the QAPP and will be implemented in conjunction with all other aspects of the DMP. Care has been taken to ensure consistency between the QAPP and the DMP where overlapping information is presented.

6.2 DATA MANAGEMENT RESPONSIBILITIES

This subsection describes the data management responsibilities for the project team described in Section 3 of the QAPP.

The WESTON Project Director for the Techalloy site is responsible for all RFI activities under his control, including data management. The WESTON Project Manager and Field Team Leader (FTL) will assist the WESTON Project Director and oversee administration, coordination, and operations associated with the RFI.

During field activities, the FTL will have the role of Data Coordinator and will be responsible for the day-to-day monitoring of data management activities. He/she is responsible for ensuring that the data collected from the various technical areas are properly coded and entered into the data management system.

The Data Coordinator has the authority to enforce proper procedures as outlined in this plan and to implement corrective procedures to ensure the accurate and timely flow and transfer of data. The generators of data (geologists, engineers, scientists, samplers, and laboratory analysts) will be responsible for accurate and complete documentation of data required under the task, and for ensuring that these data are presented to the Data Coordinator in a timely manner.

6.3 DATA RECORD

All samples for laboratory analysis, including QC samples, will be given a unique sample number. A listing of sample numbers, cross-referenced to chain-of-custody and shipment documents, will be maintained in the field logbook.

Two identification numbers will be used for each sample: a project sample number and a laboratory sample number. The project sample number, which highlights the sample matrix and location, will be used for presentation of the data in memoranda and reports. The laboratory sample number will be used for tracking the sample and the resulting analytical data through the laboratory.

6.3.1 Identifier Documentation

All samples for analysis, including QC samples, will be given unique sample numbers. A listing of sample numbers, cross-referenced to chain-of-custody and shipment documents, will be maintained in the sample handling logbook.

Two identification numbers, a WESTON project sample number and a WESTON-Gulf Coast Laboratories, Inc. sample identifier, will be used for each soil and groundwater sample. The project sample number, which highlights the sample matrix and location, will be used for presentation of the data in memoranda and reports. The WESTON-Gulf Coast Laboratories, Inc. identifier is assigned by the laboratory custodian at the time of sample receipt and is the primary means of tracking a sample through the laboratory.

Project Sample Numbering System

The project sample numbers will be composed of the following three components:

- Project Identifier. A three-character designation will be used to identify the facility for which the samples will be collected. For this project, it will be TC1. TC stands for Techalloy Company and the numerical designation (1,2,3...) refers to the phase of the project.
- Location and sample type for GeoProbe sampling. This shall consist of the following:

- A two-character code that refers to the SWMU around which the sample was collected. The two-character code is combined with a two-digit numerical code. The numerical code refers to the specific location around the SWMU. The individual SWMUs have been assigned the following codes:

- WS = wire slag disposal area
- BG = BG-5 oil drums
- HP = spent acid holding pond
- WW = plating wastewater disposal area
- CP = concrete evaporation pad
- BK = background sample collected upgradient from the site

- The sample locations will be numbered beginning with the northernmost grid line and numbering from west to east.

- The second part is a three-character code that refers to the sample media and the depth from which it was collected. A soil sample will be denoted by "SB," while "GW" will refer to a groundwater sample. A sample collected from a shallow depth will be denoted by "S," and a deep sample will be denoted by "D." Field QC samples will have additional character codes. "DP" denotes a duplicate sample. "FB" refers to a field blank, and "MS/MSD" denotes a matrix spike/matrix spike duplicate sample.

- Location of samples collected from monitoring wells. Samples collected from monitoring wells will be labeled with a two-character code, "MW" which stands for monitoring well. The letter code will be followed by a two-digit code that denotes the well location. There are two deep wells, MW05D and MW03DD. Samples collected from these wells will be labeled with a "D" or "DD" following the well location numbers. Field QC samples will have additional character codes. "DP" denotes a duplicate sample. "FB" refers to a field blank, and "MS/MSD" denotes a matrix spike/matrix spike duplicate sample.

Pure water trip blanks will be labeled as "PWTB01." The two digits at the end will increase consecutively depending on the number of trip blanks required.

Samples Collected with GeoProbe

- Sample No. TC1-HP01-SBD-DP would indicate the following:
 - TC - Techalloy Company site
 - 1 - collected during Phase I of investigation
 - HP01 - collected near the spent acid holding pond, location 01
 - SBD - deep soil sample
 - DP - duplicate sample
- Sample No. TC1-CP02-SBS-MS/MSD would indicate the following:
 - TC - Techalloy Company site
 - 1 - sample collected during Phase I of investigation
 - CP02 - collected near the concrete evaporation pad, location 02
 - SBS - shallow soil sample
 - MS/MSD - matrix spike/matrix spike duplicate sample
- Sample No. TC2-BK01-GWS would indicate the following:
 - TC - Techalloy Company site.
 - 2 - collected during Phase II of Investigation
 - BK01 - collected upgradient from the site, background sample, location 01
 - GWS - shallow groundwater sample

Samples Collected from Monitoring Wells

- Sample No. TC1-MW03-FB would indicate the following:
 - TC - Techalloy Company site
 - 1 - sample collected during Phase I of the investigation
 - MW03 - sample collected from Monitoring Well No. 3
 - FB - field blank sample

Laboratory Sample Identifier

The laboratory identifier for the WESTON-Gulf Coast Laboratories, Inc. will be an 11 digit number in the following format: YYMMGBBB-XXX, where YYMMGBBB is the batch number, and

YYMM = year/month (e.g., 9307);
G = Laboratory identifier (e.g., G = WESTON-Gulf Coast Laboratories, Inc.);
BBB = A computer-assigned consecutive batch number which rolls over after 999 to 001; and
XXX = A consecutively assigned sample number unique to a specified field sampling point.

Upon arrival at the laboratory, the laboratory batch number will be recorded by the laboratory custodian/sample log-in person on the chain-of-custody form and on the bottle label using a permanent marker.

6.3.2 Field Data Documentation

Field Logbook

All data collection activities performed at the site will be documented in a bound field logbook. The entries will be as detailed and descriptive as possible so that a particular situation can be recalled without relying on the collector's memory. All field logbook entries should be dated. Field logbooks will be assigned to individual field personnel for the duration of their stay in the field.

The cover of each logbook will contain the following information:

- Project name.
- Project work order number.
- Start date.
- End date.

Items that will be included in the field logbook are dates, weather conditions, times, sample intervals, field decisions and discussions, daily activities, problems encountered, and all other information that is relevant to ongoing field activities.

It will be the responsibility of each field person to photocopy all field logbook pages. Field logbooks and photocopies will be given to the WESTON Project Manager for incorporation into the project file.

Photographs

All work and sampling locations will be photographed to provide a visual record of the conditions of the Techalloy site and sampling/work locations. All rolls of film will be numbered with the roll number and picture number recorded in the field logbook. Photographs of the sampling locations will be taken with 35-mm print film.

All rolls of film used during the project will be transferred to the WESTON FTL, who will have them developed and will maintain a photograph file.

Instrument Calibration

All in-field analytical instruments applicable will be calibrated before and after each field use unless otherwise indicated in this document. Instruments will be calibrated each day during field use or more frequently as necessary. Instrument calibration and operation procedures are presented in Section 7 of the QAPP.

Geologic/Drilling Log

All drilling information will be recorded in the field logbook and transferred to a WESTON geologic drill log. An example of a geologic drill log is provided in Appendix B. A separate log will be maintained for each boring. Instrument readings from the HNu will be recorded in the notes column of the log. Upon completion of the field work, the drill log information may be entered into a computer database.

Chain-of-Custody Record

All samples collected in the field will be documented on a chain-of-custody (COC) record. An example COC record is shown in Figure 6-1. The COC record serves as a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory. Each sample at each sampling location will be recorded on a COC record, which will include the following information:

- Project name.
- Collection date and time.
- Sample identification location-specific number.
- Sample volumes and preservatives.
- Sample analyses.
- Name of person relinquishing samples.
- Name of person or establishment (e.g., Federal Express) delivering the samples.
- Name of laboratory sample custodian accepting the samples.
- Date that samples were accepted by laboratory.

381.596a

CHAIN OF CUSTODY FORM
GULF COAST LABORATORIES
TECHALLOY COMPANY, INC.
Union, Illinois

6.3.3 Laboratory Documentation

Laboratory Custody Procedures

WESTON and WESTON-Gulf Coast Laboratories, Inc. assume the responsibility for the integrity and security of the samples upon receipt once the transfer is complete. A complete presentation of the laboratory custody procedures is presented in Section 6 of the QAPP.

Laboratory Data

All analytical data documentation follows WESTON-Gulf Coast Laboratories, Inc. standard operating procedures. A complete description of the laboratory documentation procedures is presented in Section 10 of the QAPP.

6.4 DATA PRESENTATION

Data collected from the field investigation and laboratory analyses of samples will be presented in tabular form when applicable. This subsection discusses the table formats that will be used to group and summarize the data to allow for ease of viewing and assimilation. Valid results will be compared to relevant standards.

6.4.1 Field Data

Observations and measurements made in the field are collected on record sheets and recorded into the field logbook. Upon completion of the field investigation, the data will be tabulated for analyses and presentation in the report. Presentations summarizing the boring logs and potential monitoring well installations will be presented in the report.

Field parameters to be measured during groundwater sampling include pH, temperature, and specific conductance. These parameters will be summarized in tabular form and will be identified by sampling location and media.

Quantitative air monitoring data will be collected using the HNu. Instrument readings will be presented in the notes column of the geologic drill log.

Water level measurements collected from monitoring wells will be presented in a table. Groundwater elevations will be determined from the difference between water level measurements and the top of casing elevations, which is the reference point for water level measurements. Groundwater elevations will then be used to construct potentiometric surface maps.

6.4.2 Laboratory Data

Data reduction is performed by the chemical analysts and consists of calculating concentrations in samples from the raw data obtained from the measuring instruments. The complexity of the data reduction will depend on the specific analytical method and the number of discrete operations (extractions, dilutions, and concentrations) involved in obtaining a measurable sample.

For those methods using a calibration curve, sample response will be applied to the linear regression line to obtain an initial raw result, which is then factored into equations to obtain the estimate of the concentration in the original sample. Rounding will not be performed until after the final result is obtained to minimize rounding errors, and results will not normally be expressed in more than two significant figures.

Copies of all raw data and the calculations used to generate the final results will be retained on file to allow reconstruction of the data reduction process at a later date.

Data Review

System reviews are performed at all levels. The chemical analyst routinely reviews the quality of data through calibration checks, quality control sample results, and performance evaluation samples. These reviews are performed prior to submission to the Section Managers or the Analytical Project Manager.

The Section Manager and/or the Analytical Project Manager will review data for the consistency and reasonableness with other generated data and will determine if program requirements have been satisfied. Selected hard copy output of data (chromatograms, spectra, etc.) will be reviewed to ensure that results are interpreted correctly. Unusual or unexpected results will be reviewed, and a resolution will be made as to whether the analysis should be repeated.

The final routine review is performed by the Laboratory Manager prior to reporting the results to the client. Non-routine audits are performed by regulatory agencies and client representatives. The level of detail and the areas of concern during these reviews are dependent on the specific program requirements.

Data Reporting

Reports will contain final results (uncorrected for blanks and recoveries), methods of analysis, levels of detection, surrogate recovery data, and method blank data. In addition, special analytical problems and/or any modifications or referenced methods will be noted. The number of significant figures reported will be consistent with the limits of uncertainty

inherent in the analytical method. Consequently, most analytical results will be reported to no more than two (2) significant figures. Data are normally reported in units commonly used for the analyses performed. For example, concentrations in liquids are expressed in terms of weight per unit volume (e.g., micrograms per liter). Concentrations in solid or semisolid matrices are expressed in terms of weight per unit weight of sample (e.g., micrograms per kilogram).

Reported detection limits will be the concentration in the original matrix corresponding to the low level instrument calibration standard after concentration, dilution, and/or extraction factors are accounted for, unless otherwise specified by method requirements.

The final data report provided by the laboratory will be a Standard Client Report. This report contains a transmittal letter and the following items of organic and metals analyses:

- Cover page describing data qualifiers, sample collection, extraction and analysis dates, and a description of any technical problems encountered with the analysis.
- Spreadsheet sample data and QC result summaries.

Data Validation

Data validation will be performed by trained WESTON personnel. Validation will be accomplished by comparing the contents of the data packages and QA/QC results to the requirements contained in the method standard operating procedure (SOP). The validation procedures will be based on the following U.S. EPA Region V validation protocol:

- Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses - U.S. EPA, February 1988.

- Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses - U.S. EPA, July 1988.

6.5 GRAPHIC PRESENTATION

A survey will be performed to generate a **site** map showing the features of the site and the area immediately surrounding the site. The site map will serve as a **base** figure for the generation of other graphical figures for purposes of data display. Other information that may be displayed on the site map and graphical figures includes investigative locations, chemical constituent contour maps, and cross sections.

Based on geologic drilling logs, cross sections will be constructed depicting the geologic conditions at the site. These cross sections will be constructed so that they intersect at a common boring or well location. Vertical scales will be exaggerated to the horizontal scale to assist in interpretation of the subsurface.

The type of graphical displays appropriate to the Techalloy RFI report will depend upon the results of the investigations. However, the following types of data presentation are generally appropriate to these types of investigations:

- All proposed sampling and measurement locations.
- Contours illustrating groundwater flow patterns and concentrations of representative chemical constituents in groundwater and soils.
- Cross sections presenting geologic data, as well as selected groundwater flow and chemistry data.

6.6 PROJECT DOCUMENTATION

6.6.1 Project File

A project file will be established for the storage of all original data, written documents, and data collected or generated during the RFI. The project file will be kept in a central filing system. The format for the file will follow a project file format, which consists of several files for contract documents, communications, financial tracking, project surveillance and control, QA/QC and safety, data and information, reference materials, review documents, and final documents. The Project Manager will ensure the placement of all appropriate documents into the project file. Access to the project file will be limited to those people actively involved with the Techalloy RFI project.

6.6.2 Project Progress Report

The WESTON Project Manager will submit a monthly project progress report to the U.S. EPA as required in the Consent Order. Each report will summarize the progress of the RFI and will include the following information:

- A description and estimate of the percentage of the RFI completed.
- Summaries of all findings.
- Summaries of all changes made in the RFI during the reporting period.
- Summaries of all contacts with representatives of local community public interest groups or state government representatives during the reporting period.
- Summaries of all problems or potential problems encountered during the reporting period.
- Actions being taken to rectify problems.

- Changes in personnel during the reporting period.
- Project work for the next reporting period.
- Copies of daily reports, inspection reports, laboratory/monitoring data, etc.
- Revised project schedule.

6.6.3 Project Reports

A draft preliminary RFI report will be prepared to consolidate and summarize the data obtained and documented during the remedial investigation. In addition to a thorough discussion of site conditions, the report will include characterizations of subsurface features, hydrogeologic systems, and contaminant distribution. Data tables will be assembled, graphics will be generated, and internal reviews and quality control checks will be conducted.

The draft preliminary RFI report will be submitted to U.S. EPA for agency review. Agency comments will subsequently be incorporated into the final RFI report. After the final RFI report is submitted, the Corrective Measures Study will be initiated.

SECTION 7

HEALTH AND SAFETY PLAN

7.1 INTRODUCTION

This section of the Site Health and Safety Plan (HASP) defines general applicability and general responsibilities with respect to compliance with Health and Safety programs.

7.1.1 Scope and Applicability

The purpose of this Site Health and Safety Plan is to define the requirements of and designate the protocols to be followed during the Techalloy RCRA Facility Investigation (RFI) activities. Applicability extends to all government employees, contractors, subcontractors, and visitors.

Relevant sections of this plan must be reviewed and an agreement to comply with the requirements must be signed by all personnel prior to entering any Exclusion Zone or Contamination Reduction Zone.

During development of this plan consideration, was given to current safety standards as defined by OSHA/NIOSH, health effects data and standards for known constituents, and procedures designed to account for the potential for exposure to unknown substances. Specifically, the following most recent reference sources have been consulted:

- OSHA 29 CFR 1910.120 AND 40 CFR PARTS 300.150 AND 311
- OSHA 29 CFR 1926
- NIOSH Pocket Guide to Chemical Hazards (June 1990)
- (ACGIH) Threshold Limit Values (1990-1991)

All operations and equipment at the Techalloy site will comply with 29 CFR 1910.120 and other applicable portions of 29 CFR 1910 and 29 CFR 1926.

7.1.2 Visitors

All visitors who wish to enter any Contamination Reduction Zone or Exclusion Zone at the site will be required to read and verify compliance with the provisions of this HASP. In addition, visitors will be expected to comply with relevant OSHA requirements such as training (Section 7.4), medical monitoring (Section 7.6), and respiratory protection. Visitors will also be expected to provide their own protective equipment that complies with the requirements of OSHA and this HASP.

In the event that a visitor does not adhere to OSHA regulations or the provisions of this HASP, the visitor will be required to leave the work area. All non-conformance incidents will be recorded in the Site Health and Safety log.

7.2 KEY PERSONNEL/IDENTIFICATION OF HEALTH AND SAFETY PERSONNEL

7.2.1 Key Personnel

The following personnel and organizations are critical in the planned activities at the Techalloy site:

U.S. EPA Representative

Mr. William Buller
U.S. EPA
Region V
RCRA Enforcement Branch
77 West Jackson Boulevard
Chicago, Illinois 60604
(312) 886-4568

Illinois EPA Representative

Mr. Kevin Lesko
Division of Land and Pollution Control
Illinois EPA
P.O. Box 19276
Springfield, Illinois 62794
(217) 524-3271

WESTON Representatives

Project Director
Mr. John W. Thorsen, P.E., WESTON
3 Hawthorn Parkway
Vernon Hills, Illinois 60061
(708) 918-4102

Project Manager
Mr. Carlos Serna, P.G., WESTON
3 Hawthorn Parkway
Vernon Hills, Illinois 60061
(708) 918-4002

Field Team Leader
Ms. Tracy Schneider, WESTON
3 Hawthorn Parkway
Vernon Hills, Illinois 60061
(708) 918-4141

Field Sampling Personnel, WESTON
Ms. Jennifer Force
3 Hawthorn Parkway
Vernon Hills, Illinois 60061
(708) 918-4000

7.2.2 Site-Specific Health and Safety Personnel

The Site Health and Safety Coordinator (SHSC) has total responsibility for ensuring that the provisions of this HASP are adequate and are fully implemented in the field. Changing field conditions may require decisions to be made concerning adequate protection programs. Therefore, it is vital that personnel assigned as SHSC meet the additional training requirements specified by OSHA in 29 CFR 1910.120 (HASP Section 7.4.2), and be experienced and cognizant of all field conditions.

The SHSC for activities to be conducted at the Techalloy site is Tracy Schneider. Ms. Schneider has successfully completed the 40-hour certification course as well as the 8-hour Site Health and Safety Coordinator course. She has medical clearance and her fit-test is current. She is also duly qualified in First Aid and CPR, and has SHSC experience at numerous hazardous waste sites. The designated alternate is Jennifer Force (qualifications as indicated for SHSC).

7.3 TASK/OPERATION SAFETY AND HEALTH RISK ANALYSIS

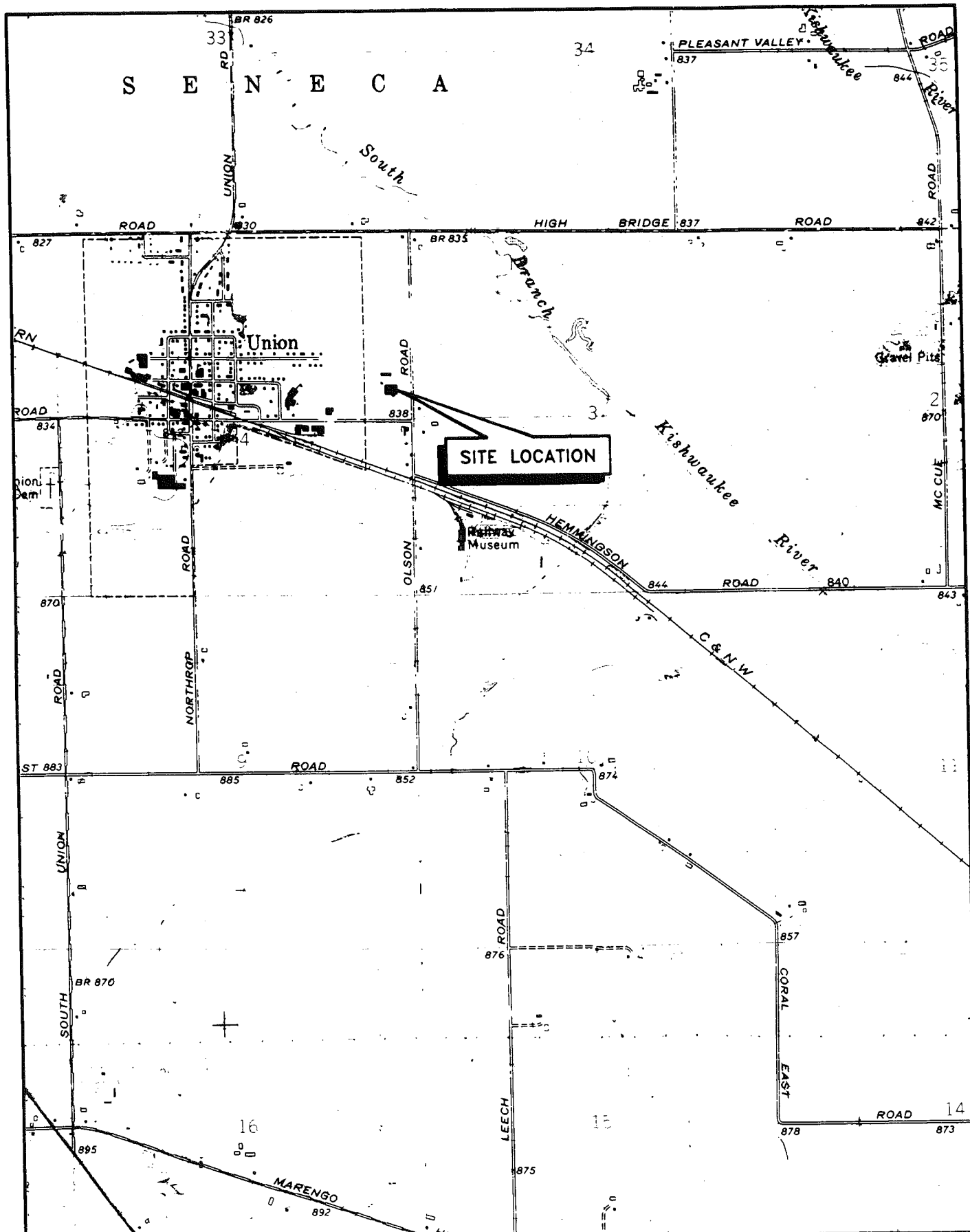
This section of the HASP defines the hazards identified during previous site work and a review of background information, as related to specific field tasks and activities.

7.3.1 Historical Overview of the Site

Background information on the Techalloy site is contained in Appendix C. The site location is shown in Figure 7-1, and the site features are depicted in Figure 7-2.

7.3.2 Task-by-Task Risk Analysis

The evaluation of hazards is based upon the knowledge of site background presented in Appendix C and anticipated risks posed by the specific tasks conducted. The following subsections describe each task/operation in terms of specific hazards associated with it. Also identified are the protective measures to be implemented during completion of those tasks/operations. Tables 7-1, 7-2, and 7-3 provide a summary of hazards and protective measures planned for each task at the Techalloy site. Appendix D provides additional information for protection against physical hazards. Please note that there is no evidence (from known past use and data collected during previous investigations at the site) suggesting a potential for the presence of radioactive materials at the site. Therefore, such hazards will not be addressed further. Table 7-4 presents the anticipated levels of personal protective equipment for each task and special comments/additions to the personal protective ensemble.

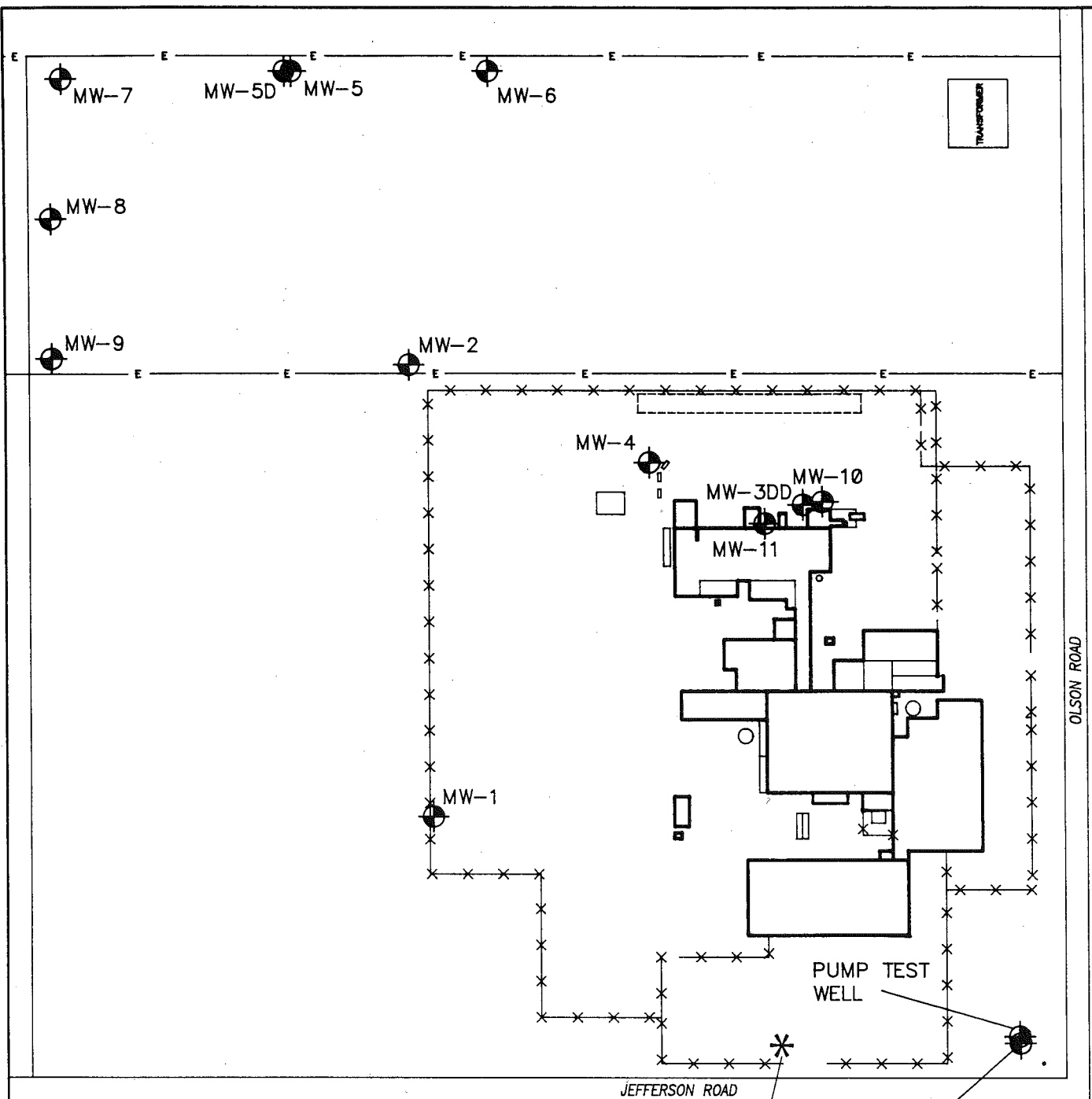


Three Hawthorn Parkway
Vernon Hills, Illinois
60061

FIGURE
7-1

SITE LOCATION
TECHALLOY COMPANY, INC.
Union, Illinois

REV.



LEGEND

- x-x FENCE LINE
- E — OVERHEAD ELECTRIC
- ⊕ EXISTING MONITORING WELL
- MW-5D EXISTING DEEP MONITORING WELL
- MW-5 EXISTING SHALLOW MONITORING WELL

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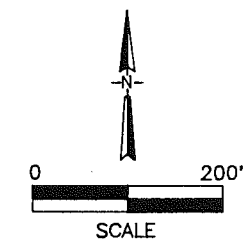


FIGURE 7-2



Three Hawthorn Parkway
Vernon Hills, Illinois
60061

SITE LAYOUT MAP
TECHALLOY COMPANY, INC.
Union, Illinois

Table 7-2

**Task Analysis Physical Hazards of Concern
 Techalloy Company, Inc.
 Union, Illinois**

Tasks	Hazard	Description	Prevention/Monitoring Technique
All tasks	Slip/Trip/Fall	Mud on wet pavement and drainage ditches	Keep work area clean of mud and debris. Extra caution when workers near ditches.
	Heat Stress	Field work in extreme warm weather.	Heat stress prevention and monitoring (see Appendix D).
	Hand and Power Tools	Shovels, wrenches, etc.	Proper usage (see Appendix D).
	Lifting Equipment	Drill cables, etc.	Frequent inspections and proper usage (see Appendix D).
	Inclement Weather	Rain, lightening, etc.	Observation and avoidance of extreme conditions (see Appendix D).
	Heavy manual lifting	Hefting material and/or equipment.	Proper lifting techniques or devices (see Appendix D).
	Cold stress	Field work in extreme cold weather.	Cold stress prevention and monitoring (see Appendix D).
Drilling and construction of monitoring wells	Drilling Rig/GeoProbe	Pinch points on drill rig/GeoProbe	Work in teams, with hard hats, safety equipment and tools, boots, exclusion zones (see Appendix D).
GeoProbe Investigation	Noise	Excessive noise at rig during drilling activities.	Hearing protection and/or limit time at drill rig during loud working activities (see Appendix D).
	Fire/Explosion	Combustible gas release potential.	Minimize ignition potential in borehole by inerting with dry ice if combustible gases present.
	Electrical	Above and below ground power lines.	Obtain utility clearances and maintain safe distances (see Appendix D).
Soil sampling	Same as above.		

Table 7-3

Task Analysis Biological Hazards of Concern*
Techalloy Company, Inc.
Union, Illinois

Task	Hazard	Description	Prevention/Monitoring Technique	Signs and Symptoms	First Aid
All tasks	Allergic Reaction/ Poisoning	Poisonous plants (i.e., poison ivy)	Recognition and avoidance of hazard. Cover skin completely/ wash thoroughly after possible exposure.	Skin reactions, itching, eye irritation, abnormal breathing and pulse, and headache.	Remove victim from source. Flush affected areas with lots of water, removing clothes with poison on them and caring for shock. Monitor airway, breathing, and circulation (ABC).
	Allergic Reaction/ Poisoning/ Disease	Insects (i.e., mosquitoes, bees)	Cover skin completely/insect repellent/buddy system to observe partner and check for insect presence.	Pain, swelling of the throat, redness or discoloration, itching, hives, decreased consciousness, difficult or noisy breathing and shock.	Remove stinger if possible. Wash with soap and water. Place a cold pack on area to reduce swelling and pain. If you see signs of allergic reactions, call EMS, care for shock and monitor ABCs.
	Bites/ Scratches/ Disease	Stray/wild animals	Buddy system	Signs of infection are pain or tenderness at the wound; redness; heat or swelling; pus; red streaks leading from the wound, swollen lymph glands, and ill feeling.	Wash wound if no heavy bleeding. Cover with clean dressing bandage and seek medical help. If wound is bleeding heavily, control bleeding and seek medical help.

* At a minimum, training in the recognition of suspected biological hazards will be given in conjunction with the site-specific health and safety training.

Table 7-4

**Anticipated Levels of Personal Protective Equipment for Each Task
 Techalloy Copany, Inc.
 Union, Illinois**

<u>Activity/Task</u>	<u>Level of Protection*</u>	<u>Comments/ Additions**</u>
GeoProbe Investigation	D	
Drilling and construction of monitoring wells	D	Modified
Groundwater sampling/ well development/ water level measurements	D	Modified
Soil sampling	D	Modified
Residential well sampling	D	
Elevation and Location Survey	D	

Notes:

* Level C protective gear will be available on site for contingency upgrades during Level D activities. In the event that Level B protective equipment is deemed necessary, all field activities requiring that level of protection will be suspended until the situation can be re-evaluated and appropriate protective gear can be mobilized to the site.

In the unlikely event that Level A protective equipment is required, all site activities will be suspended and the entire field crew will be demobilized until further notice.

** See Section 7.7.3.1.D. for action levels and potential upgrades.

7.3.2.1 Geoprobe Investigation

Groundwater and soil samples will be collected at the Techalloy facility using a Geoprobe hydraulic press. Decontaminated steel tubes three quarters of an inch in diameter are pushed/pulled into the ground using a hydraulic mechanism. The mechanism or "Geoprobe" is mounted on a four-wheel drive truck. Samples are collected through a sampling point attached to the end of the tubing. The potential for exposure to chemical hazards is expected to be minimal at all work locations during this task. Level D protection will be used by all personnel. The SHSC will perform air monitoring with an HNu at the boreholes as well as at the breathing zone during sampling operations, and pH monitoring will also be performed at the boreholes and work areas. Monitoring with an HCN monitox will be performed for work near the plating wastewater disposal area. The SHSC will be responsible for implementing the HASP and determining any level-of-protection upgrades (Subsection 7.3.1).

The potential chemical and physical hazards are presented in Tables 7-1 and 7-2. Biological hazards are indicated in Table 7-3. Utilities below ground will be located and cleared prior to any intrusive activities.

7.3.2.2 Drilling and Monitoring Well Construction

Groundwater monitoring wells will be installed at the Techalloy site using a truck-mounted drill rig. Split-spoon sampling will be conducted concurrently with the drilling operations. The potential for exposure to chemical hazards is expected to be minimal at all work locations during this task. Modified Level D protection will be used by all personnel at the drill rig, including the crew of two persons and one geologist providing supervision and oversight.

The SHSC will perform air monitoring with an HNu at the boreholes and the breathing zone during drilling operations, and pH paper monitoring at the boreholes and work areas will also be performed. Monitoring with an HCN monitox will be performed for work near the plating wastewater disposal area. The SHSC will be responsible for implementing the HASP and determining any level-of-protection upgrades (Subsection 7.7.3.1). No unusual drilling methods or site conditions are anticipated that could pose any unique health and safety considerations.

The potential chemical and physical hazards are presented in Tables 7-1 and 7-2. Biological hazards are indicated in Table 7-3. Utilities both above and below ground will be located and cleared prior to any drilling activities. Equipment shall be placed a minimum of 20 feet from electric lines or the lines shall be de-energized and/or insulated to prevent contact or arcing.

7.3.2.3 Monitoring Well Development/Groundwater Sampling/Water Levels

Upon installation, each of the monitoring wells will be developed. After well development, groundwater samples will be obtained from each monitoring well. Further, water level measurements will be taken in all wells at this time. WESTON representatives will perform these tasks. Chemical hazards associated with tasks where monitoring wells are opened and well water is removed are expected to be minimal. HNu and pH paper monitoring will be performed as an initial assessment of well conditions when the well cap is removed (and throughout the task as warranted). HCN monitox monitoring will be performed as indicated for the drilling and monitoring well construction task. Depending on the weather, heat or cold stress could be a hazard. There is also the usual slip/trip/fall physical hazard. The potential chemical and physical hazards are indicated in Tables 7-1 and 7-2. Biological hazards are as indicated in Table 7-3. Modified Level D protection will be used. The SHSC will be responsible for implementing the HASP and determining any level of

protection upgrades (Subsection 7.7.3.1). Groundwater sampling procedures are presented in detail in the Field Sampling Plan (FSP), Appendix A to the Quality Assurance Project Plan (QAPP).

7.3.2.4 Soil Sampling

Subsurface soil samples will be collected using a truck-mounted drill rig during installation of monitoring wells. Sample collection will be conducted concurrently with drilling operations. The potential for exposure to chemical hazards is expected to be minimal at all work locations during this task. Modified Level D protection will be used by all persons at the drill rig including a drilling crew of two persons and one geologist providing supervision and oversight.

The SHSC will perform air monitoring at the boreholes as well as at the breathing zone with an HNu, and HCN monitox, and pH paper, as indicated for drilling operations. The SHSC will be responsible for implementing this HASP and determining any level-of-protection upgrades (Subsection 7.7.3.1). No unusual drilling methods or site conditions are anticipated that could pose any unique health and safety considerations.

The potential chemical and physical hazards are presented in Tables 7-1 and 7-2. Biological hazards are indicated in Table 7-3. Utilities both above and below ground will be located and cleared prior to any drilling activities. Equipment shall be placed a minimum of 20 feet from electric lines or the lines shall be de-energized and/or insulated to prevent contact or arcing.

7.3.2.5 Residential Well Sampling

Seven residential wells near the Techalloy site will be sampled directly from water spigots during the private well sampling phase. Significant concentrations of constituents in the well water are not expected. Slip/trip/fall hazards are possible. Level D protection will be used. There is no contingency to upgrade the level of protection. Chemical, physical, and biological hazards are as presented in Tables 7-1, 7-2, and 7-3, respectively.

7.3.2.6 Elevation and Location Survey

Upon completion of installation, all wells will be surveyed. Vertical control measurements will include top of well (inner and protective casings) and surrounding grade. The potential for exposure to chemical hazards is expected to be minimal; therefore, work will be performed in Level D protection with HNu and HCN monitox monitoring as warranted by actual site conditions observed during earlier tasks. As a precaution, wells will be opened by WESTON personnel and allowed to vent for 5 minutes prior to surveying. Where possible, work will be performed from an upwind location. The survey crew will have a minimum of 24-hour training, with additional training as appropriate. Otherwise, the crew will perform their survey from off-site locations where no exposure potential exists, with on-site assistance from WESTON. Physical and biological hazards are as indicated in Tables 7-2 and 7-3.

7.4 PERSONNEL TRAINING REQUIREMENTS

All site personnel will be trained in accordance with OSHA's 29 CFR 1910.120 regulation covering Hazardous Waste Operations and Emergency Response. At a minimum, all personnel will be trained to recognize the hazards associated with each task, the

requirements of this HASP, site-specific emergency procedures and associated responsibilities.

7.4.1 Preassignment and Annual Refresher Training

Each employer will be responsible for certifying that its employees meet the requirements of 40-hour preassignment training and an 8-hour annual refresher training in compliance with OSHA regulations, prior to arrival on site. This training shall cover hazard recognition, respiratory protective equipment use, and site operations. Each employee will provide a document certifying dates of training attendance and latest annual refresher training.

7.4.2 Site Supervisors Training

Consistent with OSHA 29 CFR 1910.120 paragraph (e)(4), individuals designated as site supervisors require an additional 8 hours of training. The specific training requirements for supervisors include, but are not limited to, principles of supervision, elements of health and safety decision making, the employer's health and safety program and associated employee training program, PPE program, spill containment program, and health hazard monitoring procedures and techniques.

The following individuals are identified as site supervisors:

<u>Name</u>	<u>Title/Responsibility</u>
Carlos Serna	Project Manager/Project Management
Tracy Harding	Geologist/Field Team Leader

7.4.3 Training and Briefing Topics

Site-specific training will be held at the beginning of field activities. In addition, periodic briefings will be held through-out the field program. All on-site training meetings and safety briefings held at the Techalloy facility will be documented in the field logbook. The site-specific training and the periodic briefings will cover the following information (referenced to section of this HASP and Federal Regulations where appropriate):

Site-Specific Training Meeting	<u>Daily</u>	<u>Period- ically</u>	
<u>X</u>	—	<u>X</u>	Site characterization and analysis, Appendix C and Sec. 7.3; 29 CFR 1910.120(i).
<u>X</u>	—	<u>X</u>	Chemical hazards, Table 7-1.
Site-Specific Training Meeting	<u>Daily</u>	<u>Period- ically</u>	
<u>X</u>	—	<u>X</u>	Physical hazards, Table 7-2.
<u>X</u>	—	<u>X</u>	Biological hazards, Table 7-3.
<u>X</u>	—	<u>X</u>	Site control, Sec. 7.8; 29 CFR 1910.120(d).
<u>X</u>	—	<u>X</u>	Training requirements Sec. 7.4; 29 CFR 1910.120(e).
<u>X</u>	—	<u>X</u>	Medical surveillance Sec. 7.6; 29 CFR 1910.120(f).
<u>X</u>	—	<u>X</u>	Engineering controls and work practices, Sec. 7.8; 29 CFR 1910.120(g).

<u>Site-Specific Training Meeting</u>	<u>Daily</u>	<u>Period- ically</u>	
<u>X</u>	—	<u>X</u>	Heavy machinery. Appendix D.
<u>X</u>	—	<u>X</u>	Equipment. Appendix D.
<u>X</u>	—	<u>X</u>	Tools. Appendix D.
<u>X</u>	—	<u>X</u>	Overhead and underground utilities. Appendix D.
<u>X</u>	—	<u>X</u>	Personal protective equipment, Sec. 7.5; 29 CFR 1910.120(g); 29 CFR 1910.134.
<u>X</u>	—	<u>X</u>	Level B Personal Protective Equipment.
<u>X</u>	—	<u>X</u>	Level C Personal Protective Equipment.
<u>X</u>	—	<u>X</u>	Level D Personal Protective Equipment.
<u>X</u>	—	<u>X</u>	Respiratory protection Sec. 7.5.9; 29 CFR 1910.120(g); Z88.2-1980, Appendix F.
<u>X</u>	—	<u>X</u>	Air Monitoring, Sec. 7.7; 29 CFR 1910.120(h).
<u>X</u>	—	<u>X</u>	Decontamination, Sec. 7.9; 29 CFR 1910.120(k).
<u>X</u>	—	<u>X</u>	Emergency response, Sec. 7.10; 29 CFR 1910.120(l).
<u>X</u>	—	<u>X</u>	Elements of an emergency response, Sec. 7.10; 29 CFR 1910.120(l).
<u>X</u>	—	<u>X</u>	Procedures for handling site emergency incidents, Sec. 7.10; 29 CFR 1910.120(l).
<u>X</u>	—	<u>X</u>	Shipping and transport, 49 CFR 172.101; IATA Dangerous Goods Regulations.

Site-Specific Training Meeting	Daily	Period- ically	
<u>X</u>	—	<u>X</u>	Fire extinguishers. Appendix D.
<u>X</u>	—	<u>X</u>	Sanitation, 29 CFR 1910.120(n).
<u>X</u>	—	<u>X</u>	Illumination, 29 CFR 1910.120(m). Appendix D.

7.5 PERSONAL PROTECTIVE EQUIPMENT TO BE USED

This section describes the general requirements of the U.S. EPA-designated Levels of Protection (A-D), and the specific levels of protection required for each task at the Techalloy site.

7.5.1 Levels of Protection

Personnel must wear protective equipment when response activities involve known or suspected atmospheric contamination; when vapors, gases, or particulates may be generated by site activities; or when direct contact with skin-affecting substances may occur. Full facepiece respirators protect lungs, gastrointestinal tract, and eyes against airborne toxicants. Chemical-resistant clothing protects the skin from contact with skin-destructive and absorbable chemicals.

The specific levels of protection and their necessary components have been divided into four categories according to the degrees of protection afforded:

- **Level A:** Should be worn when the highest level of respiratory, skin, and eye protection is needed.

- **Level B:** Should be worn when the highest level of respiratory protection is needed, but a lesser level of skin protection is needed. Level B is the primary level of choice when encountering unknown environments.
- **Level C:** Should be worn when the criteria for using air-purifying respirators are met, and a lesser level of skin protection is needed.
- **Level D:** Should be worn only as a work uniform and not on any site with respiratory or skin hazards, as it provides minimal protection against chemical hazards.

Modifications of these levels are permitted and routinely employed during site work activities to maximize efficiency. For example, Level C respiratory protection and Level D skin protection may be required for a given task. Likewise, the type of chemical protective ensemble (i.e., material, format) will depend upon constituents, degrees of contact, etc.

The Level of Protection to be selected during activities at the Techalloy site will be based upon the following:

- Type and measured concentration of the chemical substance in the ambient atmosphere and its toxicity.
- Potential for exposure to substances in air, splashes of liquids, or other direct contact with material due to work being conducted.
- Knowledge of chemicals disposed along with properties such as toxicity, route of exposure, etc.

7.5.2 Level A Personal Protective Equipment

Based upon the existing conditions present at the Techalloy facility, Level A protective equipment will not be necessary. However, if Level A protective equipment is deemed

necessary based upon monitoring during the investigation all activities on site will be suspended and further activities will be re-evaluated.

7.5.3 Level B Personal Protective Equipment

Based upon the existing conditions and anticipated hazards present at the Techalloy facility, it is not anticipated that Level B protective equipment would be necessary. However, if Level B protective equipment is deemed necessary during the investigation all activities on site will be suspended and further activities will be re-evaluated.

7.5.4 Level C Personal Protective Equipment

Based upon existing conditions and potential hazards, Level C protective equipment may be required at times during activities at the Techalloy site. If Level C is required, the following components must be worn:

- Air-purifying respirator, full-face, cartridge equipped (OSHA/NIOSH approved).
- Chemical-resistant clothing (i.e., coveralls; hooded, one-piece or two-piece chemical splash suit; chemical-resistant hood and apron; disposable chemical-resistant coveralls).
- Coveralls or work uniform.
- Gloves (outer), chemical-resistant.
- Gloves (inner), chemical-resistant.
- Boots (outer), ANSI-approved safety boots.
- Boot covers (outer), chemical-resistant (disposable).

- Hard hat (as necessary).
- Ear plugs (as necessary).

7.5.5 Level D Personal Protective Equipment

Based upon existing conditions and potential hazards, Level D, at a minimum, would be required during intrusive activities at the Techalloy site. Components of Level D include:

- Coveralls (disposable) or work uniform.
- Gloves (outer).
- ANSI-approved safety boots.
- Safety glasses or goggles.
- Hard hat.
- Ear plugs (as necessary).

7.5.6 Reassessment of Protection Program

Upon approval of the SHSC and WESTON's Health and Safety Department, the level of personal protective equipment to be used will be upgraded or downgraded based upon a change in site conditions or findings of investigations. If a significant change occurs, the hazards will be reassessed. Indicators of the need for reassessment are:

- Commencement of a new work phase, such as work that begins on a different portion of the site.
- Change in job tasks during a work phase.
- Change of significant wind direction/season/weather.
- Contaminants other than those previously identified are being handled.

- Change in ambient levels of constituents.
- Change in work scope that effects the degrees of contact with contaminants.

7.5.7 Specific Levels of Protection Planned for the Techalloy Site

The following levels of protection will be utilized during activities at the Techalloy site (including the contingency levels of protection):

<input type="checkbox"/> Level A:	<input type="checkbox"/> modified
<input type="checkbox"/> Level B:	<input type="checkbox"/> modified
<input checked="" type="checkbox"/> Level C:	<input type="checkbox"/> modified
<input checked="" type="checkbox"/> Level D:	<input checked="" type="checkbox"/> modified

Table 7-4 presents the anticipated levels of personal protective equipment for each task and special comments/additions to the personal protective ensemble.

Table 7-5 lists the specific components of each Level of Protection planned for activities at the Techalloy site.

7.5.8 Chemical Resistance and Integrity of Protective Material

The selection of protective clothing will be based upon a review of the manufacturer's findings as to chemical resistance, permeation, resistance, integrity, and the specific tasks to be performed. Only those items found to provide acceptable protection will be utilized.

7.5.9 Standard Operating Procedures for Respiratory Protection Devices

The following subsections define standard operating procedures for air purifying respirators. Appendix F discusses the respiratory protection program.

Table 7-5

**Specific Components of Levels of Protection
Techalloy Company, Inc.
Union, Illinois**

/X/ Level D

Tasks:

Tasks at the Techalloy site which require Level D Protection with a contingency for Level C protection:

- GeoProbe Investigation.
- Residential Well Sampling (No Contingency for Upgrade to Level C).
- Elevation and Location Survey.

Protective Equipment:

- Work uniform or Tyvek coveralls.
- Work gloves (surgical and/or nitrile gloves, as necessary, for contact with soil or groundwater).
- ANSI-approved safety boots.
- Safety glasses.
- Hard hat (as necessary for overhead, equipment or bump hazards).
- Ear plugs (as necessary).

/X/ Modified Level D

Tasks:

Tasks at the Techalloy site which require modified Level D protection with a contingency for Level C protection:

- GeoProbe investigation.
- Drilling and construction of monitoring wells.
- Groundwater sampling.
- Soil sampling.

Table 7-5

**Specific Components of Levels of Protection (cont.)
Techalloy Company, Inc.
Union, Illinois**

Protective equipment:

- Tyvek coveralls. Note: Saranex coveralls required where wet material/splash potential is present.
- Long cotton underwear or work uniform.
- Surgical inner gloves.
- Nitrile outer gloves.
- ANSI-approved safety boots.
- Latex boot covers.
- Hard hat (as necessary for overhead, equipment or bump hazards).
- Safety glasses.
- Ear plugs (as necessary).

/X/ Level C (as contingency)

- Full-face APR w/GMC-H cartridge or equivalent.
- Tyvek coveralls. Note: Saranex coveralls required where wet material/splash potential is present.
- Long cotton underwear or work uniform.
- Surgical inner gloves.
- Nitrile outer gloves.
- ANSI-approved safety boots.
- Latex boot covers.
- Hard hat (as necessary for overhead, equipment or bump hazards).
- Ear plugs (as necessary).

7.5.9.1 Maintenance of Air Purifying Respirators (APRs)

Cleaning and Disinfecting APRs

APRs in routine use should be cleaned and disinfected at least daily. Where respirators are used only occasionally, or when they are in storage, the cleaning interval will be weekly or monthly, as appropriate.

The steps to be followed during cleaning and disinfecting APRs are as follows:

- **Respirator Disassembly.** Respirators are taken to a clean location where the filters, cartridges or canisters are removed, damaged to prevent accidental reuse, and discarded. For thorough cleaning, the inhalation and exhalation valves and any hoses are removed.
- **Cleaning.** In most instances, the cleaning and disinfecting solution provided by the manufacturer is used and is dissolved in warm water in an appropriate tub. Using gloves, the respirator is placed in the tub and swirled for a few moments. A soft brush may be used to facilitate cleaning.
- **Rinsing.** The cleaned and disinfected respirators are rinsed thoroughly in water to remove all traces of detergent and disinfectant. This is very important for preventing dermatitis.
- **Drying.** The respirators may be allowed to dry in room air on a clean surface. They may also be hung upside down like drying clothes, but care must be taken not to damage or distort the facepieces.
- **Reassembly and Inspection.** The clean, dry respirator facepieces should be reassembled and inspected in an area separate from the disassembly area to avoid contamination. Special emphasis should be given to inspecting the respirators for detergent or soap residue left by inadequate rinsing. This appears most often under the seat of the exhalation valve and can cause valve leakage or sticking.

7.5 APR Inspection and Checkout

APRs in active use should be inspected and undergo checkout at least on a daily basis. The steps to be followed during inspection and checkout are as follows:

- Visually inspect the entire unit for any obvious damages, defects, or deteriorated rubber.
- Make sure that the facepiece harness is not damaged. The serrated portion of the harness can fragment, which will prevent proper face seal adjustment.
- Inspect lens for damage and proper seal in facepiece.
- Exhalation Valve - pull off plastic cover and check valve for debris or for tears in the neoprene valve (which could cause leakage).
- Inhalation Valves (two) - screw off cartridges/canisters and visually inspect neoprene valves for tears. Make sure that the inhalation valves and cartridge retainer gaskets are in place.
- Make sure a protective cover lens is attached to the lens.
- Make sure the speaking diaphragm retainer ring is hand tight.
- Make sure that the correct cartridge is used.
- Don and perform negative and positive pressure test.

Storage of APRs

OSHA requires that respirators be stored to protect against the following:

- Dust
- Sunlight

- Heat
- Extreme cold
- Excessive moisture
- Damaging chemicals
- Mechanical damage

Clean and dried respirators will be stored in sealable plastic bags and secured from accidental damage.

7.6 MEDICAL SURVEILLANCE REQUIREMENTS

WESTON's medical monitoring program (which is a part of WESTON's Health and Safety program) is designed to track the physical condition of employees on a regular basis as well as survey pre-employment or baseline conditions. With this program, all regulatory requirements for medical monitoring are completed.

7.6.1 Baseline Monitoring

Prior to being assigned to a hazardous or a potentially hazardous activity involving the potential for exposure, each employee receives a baseline physical. For WESTON personnel, the content of the physical is determined by WESTON's medical consultant.

The baseline physical will categorize employees as fit-for-duty and able to wear respiratory protection. Documentation will be provided by each employee of the medical surveillance as well as the date of the most recent respirator fit test and certification.

7.6.2 Periodic Monitoring

In addition to a baseline physical, all employees undergo an updated physical every 12 months.

All personnel working in contaminated or potentially contaminated areas at the Techalloy site must verify current (within 12 months) medical monitoring. This is done by indicating date of last physical on the Health and Safety Plan Agreement Form (Appendix G).

7.6.3 Site-Specific Medical Monitoring

No site-specific medical monitoring will be required for individuals entering the Exclusion Zone or Contamination Reduction Zone at the Techalloy site.

7.6.4 Exposure/Injury/Medical Support

WESTON requires and provides to each employee a wide array of exposure/injury/medical support including:

- Requiring that at least one person on site must be currently certified in First Aid and CPR. See Contingency Plans for action to be taken relative to an injury or exposure.
- Identifying a local medical emergency facility capable of treating the types of injuries or exposures which could occur on this site. See Subsection 7.10.6 for identification.
- Retaining a medical emergency consultant who is on call 24 hours a day, seven days a week, to provide guidance on chemical exposure emergencies. This service may be accessed by any WESTON employee for assistance or direction of medical treatment simply by calling Environmental Medicine

Resources, Inc. (EMR), the number listed with the Emergency Agency Contact Numbers.

- All Emergency Agency Contact Telephone numbers will be prominently displayed on site (near every telephone, if available) along with a listing of the Local Medical Emergency Facility with a map and directions on how to get there. If telephones are not available on site, every site person will be shown the location of the Emergency Numbers and information.
- During the process of reviewing all Health and Safety Plans, a review of chemical, biological, and physical hazards present is conducted. Where additional testing is indicated by references or knowledge of toxicology, WESTON's Medical Consultant is contacted for appropriate action. In the case of the Techalloy site, there is no anticipated need for additional testing.
- All incidents involving injury, exposure, or the potential for either will be reported verbally to WESTON's Corporate Health and Safety Department as soon as possible, but no later than 24 hours after the incident. Corrective action to remedy unsafe conditions or activities will begin immediately. Within five days, a complete initial investigation of the incident will be made and a report will be submitted to WESTON's Corporate Health and Safety Department.

7.7 FREQUENCY AND TYPES OF AIR MONITORING/PERSONNEL SAMPLING

This section explains the general concepts of an air monitoring program and specifies the monitoring activities that will take place during activities at the Techalloy facility.

The purpose of air monitoring is to identify and quantify airborne contaminants in order to verify and determine the level of worker protection needed. Initial screening for identification is often qualitative [i.e., the constituent, or the class to which it belongs, is demonstrated to be present but the determination of its concentration (quantification) must await subsequent testing]. Two principal approaches are available for identifying and/or quantifying airborne contaminants:

- The on-site use of direct-reading instruments.
- Laboratory analysis of air samples obtained by gas sampling bag, collection media (i.e., filter, sorbent), and/or wet-contaminant collection methods.

7.7.1 On-Site Use of Direct-Reading Monitoring Instruments

Unlike air sampling devices, which are used to collect samples for subsequent laboratory analysis, direct-reading instruments provide data at the time of sampling, enabling rapid decision making. Data obtained from the real-time monitors are used to ensure proper selection of personnel protective equipment, engineering controls, and work practices. Overall, the instruments provide the user with the ability to determine if site personnel are being exposed to concentrations that exceed exposure limits or action levels for specific hazardous materials.

Of significant importance, especially during initial entries, is the potential for Immediately Dangerous to Life and Health (IDLH) conditions or oxygen deficient (less than 19.5 percent oxygen) atmospheres. Real-time monitors can be useful in identifying IDLH conditions, toxic levels of airborne contaminants, flammable or explosive atmospheres, or radioactive hazards. Periodic monitoring of conditions is critical especially if exposures have increased since initial monitoring, or if new site activities have begun. The checklist in Subsection 7.7.3.1 lists the instruments that will be used at the Techalloy site. Appendix H provides operation, maintenance, and calibration procedures for each of the instruments that will be used at the Techalloy site.

7.7.2 Personal Sampling

During site activities, the selective monitoring of high-risk workers (i.e., those who are closest to the source of contaminant generation) may be required. This is accomplished

using personal monitoring samples collected in the breathing zone and, if workers are wearing respiratory protective equipment, outside the face piece.

Those employees working closest with the source have the highest likelihood of being exposed to concentrations that exceed established exposure limits. Representative sampling approaches emphasizing worst case conditions (those employees with the greatest risk of exposure) should be performed. The sampling strategy may change if the operation or tasks change on site or if exposures are potentially increased.

There will be no personal sampling at the Techalloy facility unless it is determined that contaminant concentrations in the breathing zone exceed established exposure limits.

7.7.3 Specific Monitoring Instruments that Will be Used at the Techalloy Facility

The following checklist provides a summary of the monitoring instruments to be used and frequency/schedule of monitoring. An air sampling strategy is also defined in the checklist.

7.7.3.1 Site Air Monitoring and Sampling Program

A. Air Monitoring Instruments

- ☒ 1. Real-time PID and/or FID monitors (for organic vapors).
- ☐ 2. Real-time aerosol monitors (for particulates).
- ☐ 3. Explosimeters (for explosive environments).
- ☐ 4. Oxygen monitors (for oxygen levels).
- ☒ 5. Other: HCN Monitox (for work near plating wastewater disposal area).

B. Air Monitoring Frequency

- ☐ 1. Four times daily - twice in morning and twice in afternoon.
- ☐ 2. Twice daily - once in morning and once in afternoon.
- ☒ 3. Continuous
- ☐ 4. Other:

C. Monitoring Locations

- ☒ 1. Upwind and downwind of site activities to determine background levels (outside the Contamination Reduction Zone) and ensure site control zone boundaries remain appropriate.
- ☐ 2. Near residents, etc.
- ☒ 3. Key site activity locations:
 - ☐ decon area
 - ☒ breathing zone during drilling and sampling operations
 - ☐ staging area
 - ☐ excavation area
 - ☐ field lab area
 - ☒ borehole
 - ☐ storage tanks
 - ☒ monitoring wells, when cap is removed
 - ☐ lagoons
- ☐ 4. Fixed stations.
- ☒ 5. Other: HCN monitoring for work near plating wastewater disposal area.

D. Action Levels

- ☒ 1. Explosive atmosphere:

<u>Action Level</u>	<u>Action</u>
<10% LEL	Continue investigation.
10%-20% LEL	Continue on-site monitoring with extreme caution as higher levels are encountered.
>20% LEL	Explosion hazard. <u>Withdraw from area immediately.</u>

NA 2. Oxygen:

<u>Action Level</u>	<u>Action</u>
<19.5%	Monitor wearing self-contained breathing apparatus. NOTE: Combustible gas readings are not valid in atmospheres with <19.5% oxygen.
19.5%-25%	Continue investigation with caution as oxygen levels >21% require extreme caution. Other than normal levels may be due to presence of other substances.
>25%	Fire hazard potential. <u>Stop work immediately and consult a fire safety specialist.</u>

NA 3. Radiation:

<u>Action Level</u>	<u>Action</u>
3 x background to 1 mrem/hr	Radiation above background levels (normally 0.01-0.02 mrem/hr) ^g signifies the possible presence of radiation sources. Continue investigation with caution. Perform thorough monitoring. <u>Consult with a health physicist.</u>
>1 mrem/hr	Potential radiation hazard. <u>Evacuate AREA of high reading. Continue investigation in AREA of high reading only upon the advice of a health physicist.</u>

X 4. Organic gases and vapors:

<u>Action Level</u> <u>(OVA/HNu Units)</u>	<u>Action (Protective Equipment)</u>
BG to 5 units above BG	Level D
>5 to 20 units above BG	Level C
>20 units above BG	Level B- <u>STOP WORK</u> and reevaluate site conditions and activities.

X 5. Inorganic gases and vapors:

<u>Action Level</u>	<u>Action</u>
HCN > BG	<u>STOP WORK</u> and reevaluate site conditions and activities.

X 6. Visible Dusts:

<u>Action Level</u>	<u>Action</u>
Visible Dusts	Level C will be used and more stringent dust suppression methods will be implemented. If suppression methods are not effective, work will be halted and conditions re-evaluated along with the need for additional particulate (Mini-ram) monitoring.

E. Reporting Format

- X 1. Field notebook.
- 2. Field data sheets.
- 3. Air monitoring log.
- 4. Trip report.
- 5. Other:

7.7.3.2 Techalloy Facility Ambient Air Sampling

It is assumed for purposes of the Techalloy facility that no site ambient air sampling will be necessary. However, if sustained high readings are encountered on the real-time air monitoring instruments, the SHSC will consult with WESTON's Corporate Health and Safety Department to determine the need for ambient air sampling.

7.8 SITE CONTROL MEASURES

The following sections define the measures and procedures for maintaining site control. Site control is an essential component in the successful implementation of the site health and safety program. Table 7-6 details personnel/site control requirements for each task to be conducted at the Techalloy facility.

7.8.1 Buddy System

During all tasks, the implementation of a buddy system is mandatory. A buddy system requires at least two people who work as a team, each looking out for each other (Level B operations require three people). Table 7-6 also lists those tasks which require a buddy system and any additional requirements.

7.8.2 Site Communications Plan

Successful communication between field teams and personnel in the support zone is essential. The following communications systems will be available during activities at the Techalloy facility.

- ☒ Radios: Two way (intrinsically safe)
- ☒ Compressed air horn
- ☒ Hand signals: For communications at the operations drill rig, standard signals will be used.

7.8.3 Work Zone Definition

The Exclusion Zone is defined as the area where contamination is either known or likely to be present, or because of activity will provide a potential to cause harm to personnel.

Table 7-6
Personnel/Site Control Requirements By Task
Techalloy Company, Inc.
Union, Illinois

Task	Buddy System	Line of Sight	Comments
GeoProbe investigation	X	X	NA
Drilling, monitoring well installation	X	X	Two drillers present at rig at all times.
Soil Sampling	X	X	Two drillers present at rig at all times.
Any Physically Dangerous Tasks	X	X	
Residential Well Sampling	X	X	NA
Elevation and Location Survey	X	X	NA

NA - Not applicable.

Entry into the Exclusion Zone requires the appropriate use of personal protective equipment.

The Contamination Reduction Zone is the area in which personal and equipment decontamination is conducted. This area is essentially a buffer zone between contaminated areas and clean areas. Activities to be conducted in this zone will require levels of personal protection as defined in the decontamination plan.

The Support Zone is situated in clean areas where the chance to encounter hazardous materials or conditions is minimal. Personal protective equipment is therefore not required in this area.

Due to the location and nature of the activities to be conducted at the Navy Pier Site, a formal exclusion zone will not be established. The exclusion zone will be considered to be one boom-length (or a radius of approximately 30 feet) around each drilling or sampling location as work is in progress both on site and off site. Contamination reduction and support zones will be established in appropriate locations at each work area. As necessary, zones will be staked and marked with hazard tape to control access of unauthorized personnel.

Safe Work Practices

Standing orders for the Exclusion Zone and the Contamination Reduction Zone are listed in Tables 1 and 2.

Additional safe work practices for all areas of the site are included in the SOPs in Attachment C. At a minimum, the site shall be neat and orderly with tools, materials, and equipment stored properly and debris removed at frequent intervals.

Table 7-7

**Standing Orders for Exclusion Zone
Techalloy Company, Inc.
Union, Illinois**

- No smoking, eating, or drinking on site.
- No horseplay.
- No matches or lighters, except in designated areas.
- Check in at entrance to the site.
- Check out at exit from the site.
- Buddy system/line of sight must be in place.
- Implement the communications system.
- Wear the appropriate level of protection as defined in the HASP.

Table 7-8

**Standing Orders for Contamination Reduction Zone
Techalloy Company, Inc.
Union, Illinois**

- No smoking, eating, or drinking in this zone.
- No horseplay.
- No matches or lighters in this zone.
- Wear the appropriate level of protection as defined in the HASP.

7.9 DECONTAMINATION PLAN

Table 7-4 lists the tasks and specific levels of protection required for each. Consistent with the levels of protection required, Figures 7-3 and 7-4 provide a step-by-step representation of the personnel decontamination process for Levels C and D.

7.9.1 Levels of Decontamination Protection Required for Personnel

The levels of protection required for personnel assisting with decontamination will be modified Level D. Depending upon changes in site conditions and/or concentrations of contaminants, an upgrade to level C may be required.

7.9.2 Equipment Decontamination

Sampling and drilling equipment will be decontaminated in accordance with procedures as defined in the FSP. All other drilling equipment will be washed down with water at high pressure to volatilize and remove contamination and visible dirt, and will be allowed to air dry. Proper protective gloves are required during pressure washing. These gloves must be surgical and nitrile gloves, at a minimum.

7.9.3 Disposition of Decontamination Wastes

All solid and liquid wastes generated during drilling and sampling activities will be drummed and stored on site, until appropriate disposal action is identified by WESTON and the U.S. EPA. Borehole cuttings and used safety/protective clothing will be placed in 55-gallon drums in a segregated manner and handled as solid waste. All decontamination washes/rinses/ drippings, drill rig/heavy machinery wash down water, and well development

Figure 7-3

**Level C Decontamination
Techalloy Company, Inc.
Union, Illinois**

- Step 1 Segregated equipment drop
- Step 2 Boot cover and glove wash (as necessary)
- Step 3 Boot cover and glove rinse (as necessary)
- Step 4 Tape removal
- Step 5 Boot cover removal
- Step 6 Outer glove removal

----- HOT LINE -----

- Step 7 Suit removal
- Step 8 Face piece removal
- Step 9 Inner glove removal

----- CRZ/SUPPORT ZONE BOUNDARY -----

- Step 10 Field wash
- Step 11 Redress

Figure 7-4

Level D Decontamination*
Techalloy Company, Inc.
Union, Illinois

- Step 1 Segregated equipment drop
- Step 2 Boot cover and glove wash (as necessary)
- Step 3 Boot cover and glove rinse (as necessary)
- Step 4 Boot cover removal
- Step 5 Outer glove removal

----- **HOT LINE** -----

- Step 6 Suit removal
- Step 7 Inner glove removal

----- **CRZ/SUPPORT ZONE BOUNDARY** -----

- Step 8 Field wash
- Step 9 Redress

*Note: This figure refers to Level D or Modified Level D Decontamination as appropriate. Steps which are not applicable for a given Task will be omitted.

water and well purging water will be handled as liquid wastes and stored in 55-gallon drums until disposal.

7.10 EMERGENCY RESPONSE/CONTINGENCY PLAN

This section describes contingencies and emergency planning procedures to be implemented at the Techalloy facility.

7.10.1 Pre-Emergency Planning

During the site briefings held periodically/daily, all employees will be trained in and reminded of provisions of the emergency response plan, communication systems, and evacuation routes.

As necessary, the emergency response plan will be reviewed and revised (with proper approvals) by the SHSC in order to ensure that it is adequate and up-to-date with prevailing site conditions.

7.10.2 Lines of Authority

The SHSC has primary responsibility for responding to and correcting emergency situations. This includes taking appropriate measures to ensure the safety of site personnel and the public. Possible actions may involve evacuation of personnel from the site area and evacuation of residents adjacent to the site. The SHSC is additionally responsible for ensuring that corrective measures have been implemented, appropriate authorities notified, and any follow-up reports completed.

The individual subcontractor organizations are responsible for assisting the SHSC in his/her mission within the parameters of their scope of work.

7.10.3 Emergency Recognition/Prevention

Tables 7-1, 7-2, and 7-3 provide a listing of chemical, physical, and biological hazards on site. Additional hazards as a direct result of site activities are listed in Table 7-9, along with prevention and control techniques/mechanisms.

7.10.4 Evacuation Routes/Procedures

In the event of an emergency which necessitates an evacuation of the site, an air horn will be sounded three times in succession. Personnel will be expected to proceed to the exit (in pairs if possible) and mobilize to the muster area associated with the evacuation route. Personnel will remain at that area until an authorized individual provides further instructions.

Figure 7-2 provides a map depicting the site, including the primary muster area. Additional (secondary and tertiary) muster areas and designated safe distances in the event of a major incident will be identified and conveyed to all site personnel prior to the start of work.

7.10.5 Emergency Equipment/Facilities

The following emergency equipment will be provided at the Techalloy site. The locations of such equipment will be conveyed to all site personnel prior to the start of work.

X First Aid Kit
X Fire Extinguisher
 Stretcher

X Bloodborne Pathogens Kit

Table 7-9

Emergency Recognition/Control Measures
Techalloy Company, Inc.
Union, Illinois

Hazard	Specific Condition/Location	Prevention/Control
Fire/explosion	Drill rig malfunction Equipment malfunction	Fire extinguisher at rig/site Segregation of combustibles and ignition sources Appropriate monitoring Safety cans for fuels (if applicable) Daily fire inspections
Air and/or other gaseous release	Boreholes on site Opening monitoring wells	Appropriate monitoring Evacuation routes

- ☒ Eye Wash (located not more than 100 feet or 10 seconds away from hazard)
- ☐ Emergency Shower
- ☐ Public Telephone
- ☐ Site Telephone
- ☒ Mobile Telephone
- ☐ Two-way Radio
- ☒ Off-site Telephone
- ☐ Sorbent Material
- ☒ Spill Kits
- ☐ Emergency SCBAs
- ☒ Other (Posted safety plan)
- ☒ Wind direction indicators visible to all site workers.
- ☒ Drums
- ☐ Berm Material
- ☐ Air Monitoring Stations

7.10.6 Emergency Contact/Notification System

The names and telephone numbers for emergency organizations/personnel that may need to be contacted are detailed in Table 7-10.

7.10.7 Medical Emergencies

7.10.7.1 Response to Medical Emergencies

In the event of an injury or exposure, trained site personnel will administer first aid up to the level of their training. The following WESTON individuals have current certification in CPR and First Aid:

Scott Koepsell
Tracy Harding
Jennifer Force

If there is any indication of need, or the injured/exposed personnel, the SHSC, or the Site Manager believes there is need, additional examination and care will be obtained at the local medical emergency facility.

Table 7-10

Emergency Contacts
Techalloy Company, Inc.
Union, Illinois

Organization	Contact	Telephone Number
Ambulance: McHenry County	Dispatch	911
Fire Department: McHenry County	Dispatch	911
Police Department: McHenry County	Dispatch	911
Woodstock Memorial Hospital 527 West South Street Union, Illinois	Emergency Room	(815) 338-2500
Marengo Rescue Squad	Dispatch	(815) 568-8333
U.S. EPA National Response Center	Dispatch	(800) 424-8802
WESTON Medical Emergency	EMR - Dr. Barnes	(800) 229-3674
WESTON Health & Safety (24 Hours)	George Crawford	(215) 692-3030

Any person who becomes ill or injured in the exclusion zone must be decontaminated to the maximum extent possible. If the injury or illness is minor, full decontamination should be completed and first aid administered prior to transport. If the patient's condition is serious, at least partial decontamination should be completed (i.e., complete disrobing of the victim and redressing in clean coveralls or wrapping in a blanket.) First aid should be administered while awaiting an ambulance or paramedics. All injuries and illnesses must immediately be reported to the WESTON SHSC who, in turn, must report them to WESTON's Corporate Health and Safety Department.

Any person being transported to a clinic or hospital for treatment must have the information on the chemical(s) they have been exposed to at the site sent along with them.

Any vehicle used to transport contaminated personnel will be treated and cleaned as necessary.

7.10.7.2 Nearest Medical Assistance

The closest medical assistance facility is:

Woodstock Memorial Hospital
527 West South Street
Woodstock, Illinois

To get to Woodstock Memorial Hospital from the Techalloy site, exit the site onto Olson Road and head north. Turn west/left onto Highbridge Road, right/north onto Union Road, east/right onto Highway 176, north/left onto Dean Street, and west/left onto South Street to the emergency room entrance.

A map detailing the directions to the hospital is presented in Figure 7-5. Prior to the onset of site activity, the SHSC will travel this route to become familiar with the directions, streets, landmarks, potential obstacles, etc.

7.10.8 Fire or Explosion

In the event of a fire or explosion, work shall be ceased, and all personnel shall evacuate the area and be accounted for. The local fire department should be called immediately. Upon their arrival, the SHSC or designated alternative will advise the fire commander of the location, nature, and identification of the hazardous materials on site.

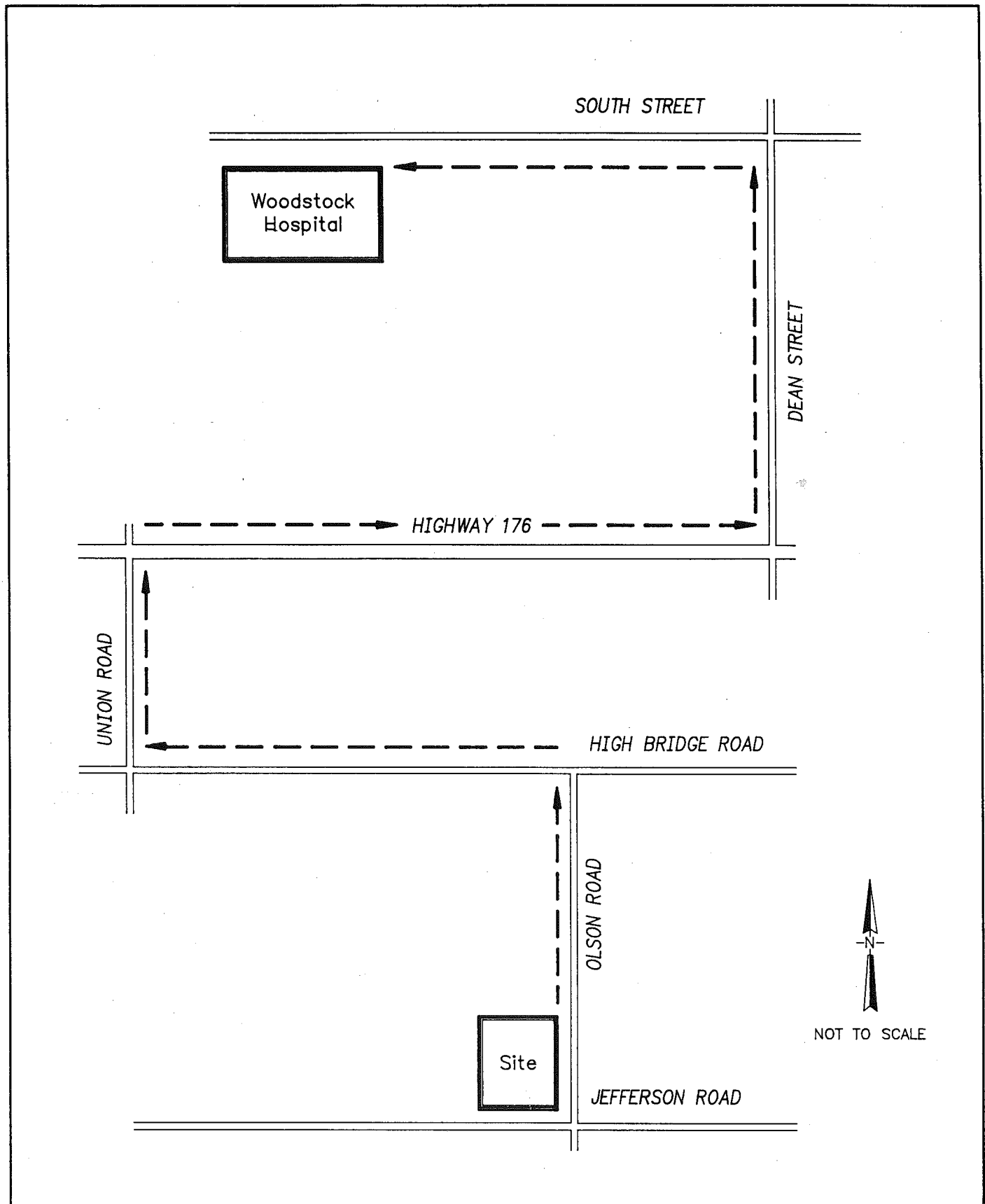
If it is safe to do so, site personnel may:

- Use portable fire extinguishers available on site to control or extinguish an incipient stage fire.
- Remove or isolate flammable or other hazardous materials which may contribute to the fire.

7.10.9 Spill or Leaks

In the event of a spill or a leak, site personnel will:

- Inform SHSC immediately.
- Locate the source of the spillage.
- Assess the situation.
- Determine safety equipment needs.
- Stop the flow if it can be done safely.
- Begin containment and recovery of the spilled materials.



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FIGURE 7-5



Three Hawthorn Parkway
Vernon Hills, Illinois
60061

EMERGENCY ROUTE TO HOSPITAL
TECHALLOY COMPANY, INC.
Union, Illinois

Appropriate spill response gear and materials will be maintained in readiness on site in the WESTON vehicle, or where easily accessible.

All site personnel will be shown the location of spill response gear and materials during site indoctrination training.

SECTION 8

COMMUNITY RELATIONS PLAN

8.1 OVERVIEW

Community relations is a useful and important aspect of the RCRA Facility Investigation (RFI) and Corrective Measures Study (CMS) processes. Community relations activities keep members of the community(ies) informed of the activities at the site, and will assist Techalloy Company, Inc. and U.S. EPA to anticipate and respond to community concerns. The required community relations activities are the foundation for more comprehensive and effective activities that may be necessary to incorporate into a basic community relations program to address specific site/community needs. All community relations activities at the site need to be integrated closely with the overall goals for the site. Basic objectives of community relations activities undertaken throughout most environmental projects are as follows:

- Inform the public of planned and/or ongoing activities.
- Provide the public the opportunity to comment on and provide input to technical decisions.
- Focus on community understanding of the actions and resolve conflict.

8.2 RFI/CMS COMMUNITY RELATIONS TASKS

The following tasks describe the approaches required per the U.S. EPA Scope of Work for the Techalloy Illinois, Inc. community relations plan.

8.2.1 Task 1 - Community Interviews

Community interviews are conducted to meet the following purposes:

- To identify major community concerns regarding the facility.
- To identify the residents, community leaders, and officials in the area who are especially interested in the facility and should be kept apprised of the investigations and corrective measures.
- To identify the best means to provide information to the public and, in return, to obtain public comment and input.

Through coordination with Techalloy and U.S. EPA RCRA, WESTON will identify key local officials and residents, and schedule personal interviews to discuss the site, U.S. EPA RCRA involvement, and community perceptions. Identifying and interviewing key individuals or groups offer an understanding of the site's history and community involvement with the site from the community's perspective. Key individuals are local residents, government officials, environmental groups, and other individuals interested in site activities. Community interviews are excellent sources of opinions/fears, expectations, and concerns regarding corrective measures. The face-to-face interviews provide the means to identify credible sources and disseminators of information, and to lay the groundwork for developing an effective community relations program for the site.

WESTON will confirm in writing the scheduled interview with each local contact. Based on the telephone conversations with the key local contacts, WESTON will prepare a list of questions concentrating on the preliminary information. This prepared list of questions will assist Techalloy and WESTON to generate discussion and facilitate the exchange of information at the time of the interview.

At the beginning of each interview, the interviewee will be assured that their statements will remain confidential, and that the RCRA Public Involvement Plan will be placed in the site's information repository for public review. Interviewees will be asked if they would like their names, addresses, and telephone numbers on the contact list, and to identify other possible contacts to be added to the community interview process. The interviewer should be sensitive to the residents' needs, and should remind them that the purpose of the interview is to gather preliminary information for planning an appropriate program for citizen participation. At the same time, specific concerns of residents are discussed; for example, threat to health, economic loss, company/agency credibility, level of community involvement, and the media.

In addition to conducting the on-site interviews in Union, Illinois, WESTON will investigate appropriate locations for an Information Repository and public meetings, begin the site mailing list, purchase area newspapers, and obtain local literature regarding the community of Union and the site.

8.2.2 RCRA Public Involvement Plan

Based on the information collected during the community interviews, WESTON will prepare a RCRA Public Involvement Plan. Sections of the RCRA Public Involvement Plan will include:

- Introduction - Statement of purpose of the document.
- Project History - Overview of the project.
- Community Concerns - Summary of the concerns identified during the community interviews.
- Objectives of the Public Involvement Plan - Description of objectives to address the specific community concerns outlined in the previous section.

- **Public Involvement Activities** - Description of specific activities (e.g., fact sheets, public meetings) to meet the objectives listed in the previous section and RCRA public involvement requirements, and a schedule for conducting those activities.
- **Attachments** - Lists of key contacts, media contacts, and public meeting and information repository locations.

Techalloy will submit a draft RCRA Public Involvement Plan to U.S. EPA for review.

SECTION 9

REFERENCES

B.W. Ray and H.L. Wascher, *McHenry County Soils*, University of Illinois and U.S. Department of Agriculture, 1965.

H.B. Willman, *Summary of the Geology of the Chicago Area*, Circular 460, Illinois State Geological Survey, 1971.

G.M. Hughes, P. Kraatz, R.A. Landon, *Bedrock Aquifers of Northeastern Illinois*, Circular 406, Illinois State Geological Survey, 1966.

PRC Consultants, *Preliminary Assessment: Techalloy Illinois, Inc.*, 8 November 1981.

U.S. EPA, *Guidance for Public Involvement in RCRA Section 3008(h) Actions*, OSWER Directive 9901.3, 5 May 1987.

U.S. EPA, *Guidance on Public Involvement in the RCRA Permitting Program*, Office of Solid Waste, January 1986.

U.S. EPA, *RCRA Corrective Action Plan Interim Final*, EPA/530-SW-88-028, June 1988.

U.S. EPA, *Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses*, February 1988.

U.S. EPA, *Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses*, July 1988.

U.S. EPA, *Guidance for Public Involvement in RCRA Section 3008(h) Actions*, OSWER Directive 9901.3, 5 May 1987.

U.S. EPA, *Guidance on Public Involvement in the RCRA Permitting Program*, Office of Solid Waste, January 1986.

WESTON, *RFI Quality Assurance Project Plan (Draft)*, Techalloy Company, Inc., Union, Illinois, April 1993.

WESTON, *Phase II Soil and Groundwater Investigation*, Techalloy Company, Inc., Union, Illinois, June 1991.

Work Plan
Techalloy RFI
Section: 9
Revision: 0
Date: 27 April 1993
Page: 9-2 of 2

WESTON, *Private Well Sampling Plan (Draft)*, Techalloy Company, Inc., Union, Illinois,
February 1993.


WESTON, *Interim Measures Work Plan (Draft)*, Techalloy Company, Inc., Union, Illinois,
April 1993.

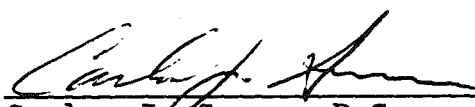
APPENDIX 2-A

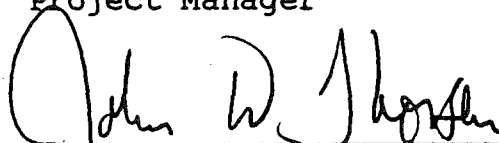
PHASE II SOIL AND GROUNDWATER INVESTIGATION REPORT

PHASE II SOIL AND
GROUNDWATER INVESTIGATION
TECHALLOY COMPANY INCORPORATED
UNION, ILLINOIS

Prepared for
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June 1991

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A Geologic Well Logs



PROJECT PARTICIPANTS

The following members of the staff of Roy F. Weston, Inc., have participated in the planning and execution of this project and preparation of this report:

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Technical Editor/Publications
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SECTION 1

INTRODUCTION

1.1 OVERVIEW

Pursuant to the request of Techalloy Company, Inc. (Techalloy), Roy F. Weston, Inc. (WESTON) conducted a Phase II Soil and Groundwater Investigation at the Techalloy property located at the intersection of Olson Road and Jefferson Street in Union, Illinois. The Phase II investigation addressed specific issues previously identified by WESTON. Specific issues of concern identified in WESTON's proposal dated 31 October 1990 include:

- The potential presence of contaminated soils acting as sources of groundwater contamination.
- The lateral and downgradient extent of groundwater contamination originating at the Techalloy facility.

1.2 SITE HISTORY AND SETTING

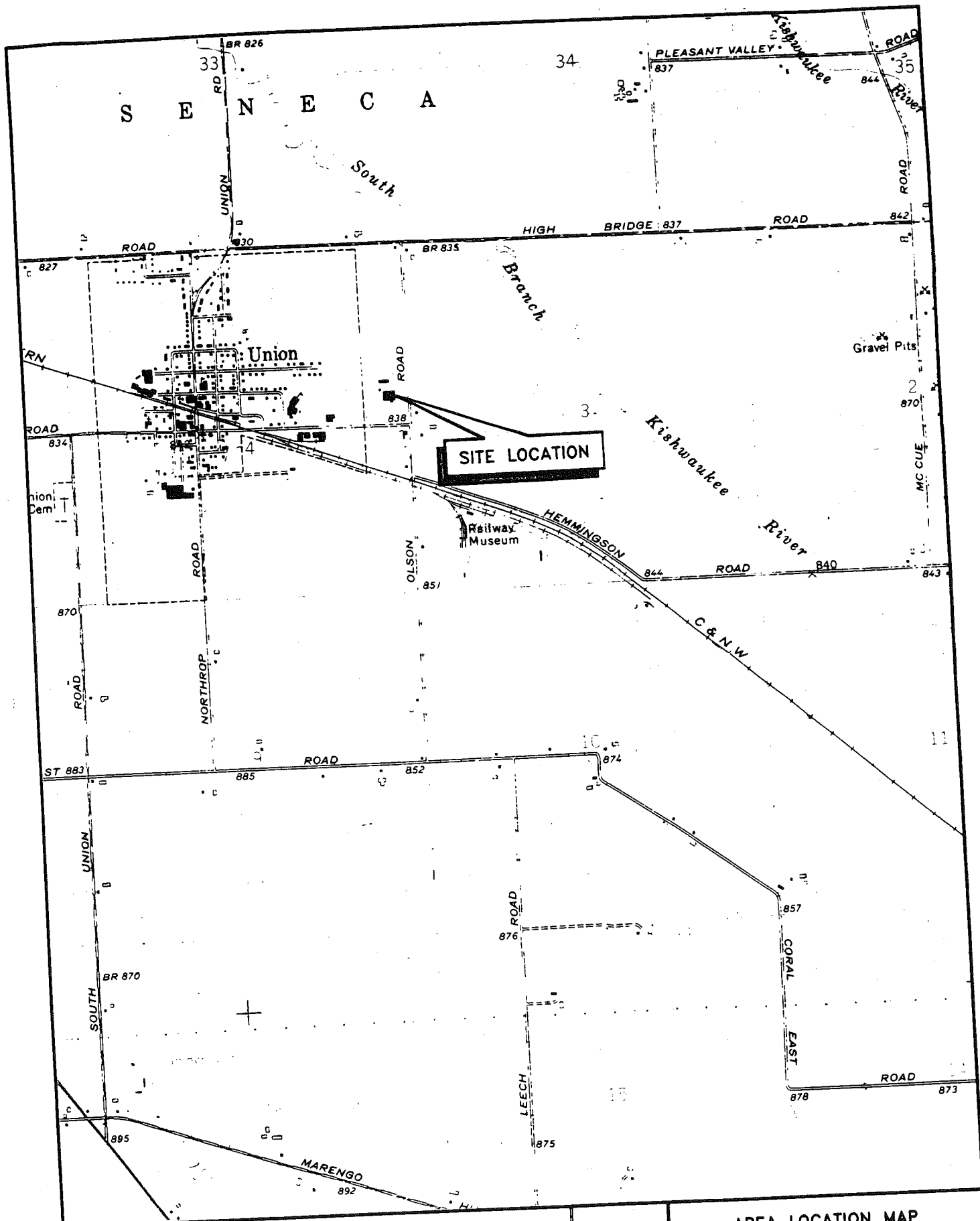
Techalloy is located at the intersection of Olson Road and Jefferson Street in Union, Illinois (Figure 1-1). Techalloy has been operating this steel wire drawing facility since 1960. Presently Techalloy processes steel and nickel alloy rod. The unprocessed metal rod is annealed and drawn into coils or spools of wire of varying strengths and diameters. A variety of coatings and cleaners are utilized in the production processes, including acidic and caustic cleaners, coating solutions, dye, and rinses.

1.3 BACKGROUND

U.S. Testing, Inc. performed an environmental assessment in January 1990. This assessment is referred to as the Phase I Investigation. As a follow-up to Phase I, WESTON, under contract to Techalloy, performed groundwater monitoring at both the site boundary and at an off-site location. The site boundary monitoring wells were installed in April 1990, and the off-site monitoring well was installed in August 1990.

The Phase I investigation consisted of soil and groundwater sampling at areas which were identified by Techalloy personnel as former waste management areas or potential spill areas. Eight soil borings, three shallow monitoring wells, and one deep monitoring well were installed during the Phase I investigation. Soil and groundwater samples were analyzed for volatile organic compounds (VOCs), metals, and petroleum hydrocarbons.

The results of the Phase I investigation indicated that both soil and groundwater in the plant area were contaminated with



WESTON
MANAGERS DESIGNERS/CONSULTANTS

Three Hawthorn Parkway
Vernon Hills, Illinois
60061

FIGURE
1-1

AREA LOCATION MAP
TECHALLOY, INCORPORATED
Union, Illinois

trichloroethene (TCE) and 1,1,1-trichloroethane (1,1,1-TCA). The highest concentration of detected VOCs in soil was 1,000 mg/kg (parts per million or ppm) of 1,1,1-TCA in a soil sample collected south of the acid house and at a depth of 2.5 feet. VOCs were also detected in all groundwater samples collected from the three shallow wells and the one deep well. The highest concentration of VOCs detected in groundwater were 2,100 ppb and 1,100 ppb of 1,1,1-TCA. Various metals, including lead, chromium, arsenic, and cadmium were also detected in both soil and groundwater.

Based on the results of the Phase I investigation, WESTON installed and sampled five additional shallow monitoring wells and one deep monitoring well along the western and northern property boundaries of the Techalloy property in April 1990. The purpose of the wells was to determine whether contaminants were present at the property boundary and to determine the potential for off-site migration of contaminants. Groundwater samples were collected from the six newly installed monitoring wells and four Phase I wells on 5 April 1990. All samples were analyzed for VOCs and metals. The sample results showed that VOCs were present in groundwater at all of the well locations sampled. The compounds 1,1,1-TCA and TCE were the VOCs present in the highest concentrations. The levels of TCE and 1,1,1-TCA detected in samples from the five wells exceeded the existing Maximum Contaminant Levels (MCLs) established by the United States Environmental Protection Agency (U.S. EPA) under the Safe Drinking Water Act (SDWA). All metals analyzed were detected below U.S. EPA drinking water standards.

In August 1990, an off-site, downgradient monitoring well was installed along the county right-of-way adjacent to North Union Road and Highbridge Road. The purpose of this well was to determine the downgradient extent of the contaminant plume. The presence of elevated VOCs in the existing wells at the property boundary indicated that VOCs had migrated an undetermined distance off-site, in a northwesterly direction. Determination of the downgradient extent of the contaminant plume was necessary for designing a groundwater extraction/treatment system. In addition, the off-site data provided information on the potential for impact to any private water wells located downgradient of the Techalloy site.

The results of analysis from the sample collected at the off-site well location detected 1,2-dichloroethene (1,2-DCE), tetrachloroethene (PCE), 1,1,1-TCA, and TCE at concentrations above the MCLs. These results indicated that the contaminant plume had migrated a minimum distance of 2,000 feet northwest of the Techalloy property. Based on these results, the extent of the contaminant plume had not fully been identified. Therefore, WESTON submitted the October 1990 Phase II proposal to further define the contaminant plume and preliminarily define potential contaminant source areas at the plant facility.

SECTION 2

FIELD INVESTIGATION METHODOLOGY

A field investigation was implemented by WESTON to further characterize subsurface conditions at and around the site. The technical approach used by WESTON to complete this portion of the Phase II effort entailed the following activities:

- A soil investigation addressing areas identified as potential sources of groundwater contamination.
- A groundwater quality investigation addressing the nature and extent of groundwater contamination.

2.1 SOIL INVESTIGATION

The Phase II soil sample locations were situated to determine the chemical nature of shallow subsurface soils and identify potential source areas of groundwater contamination.

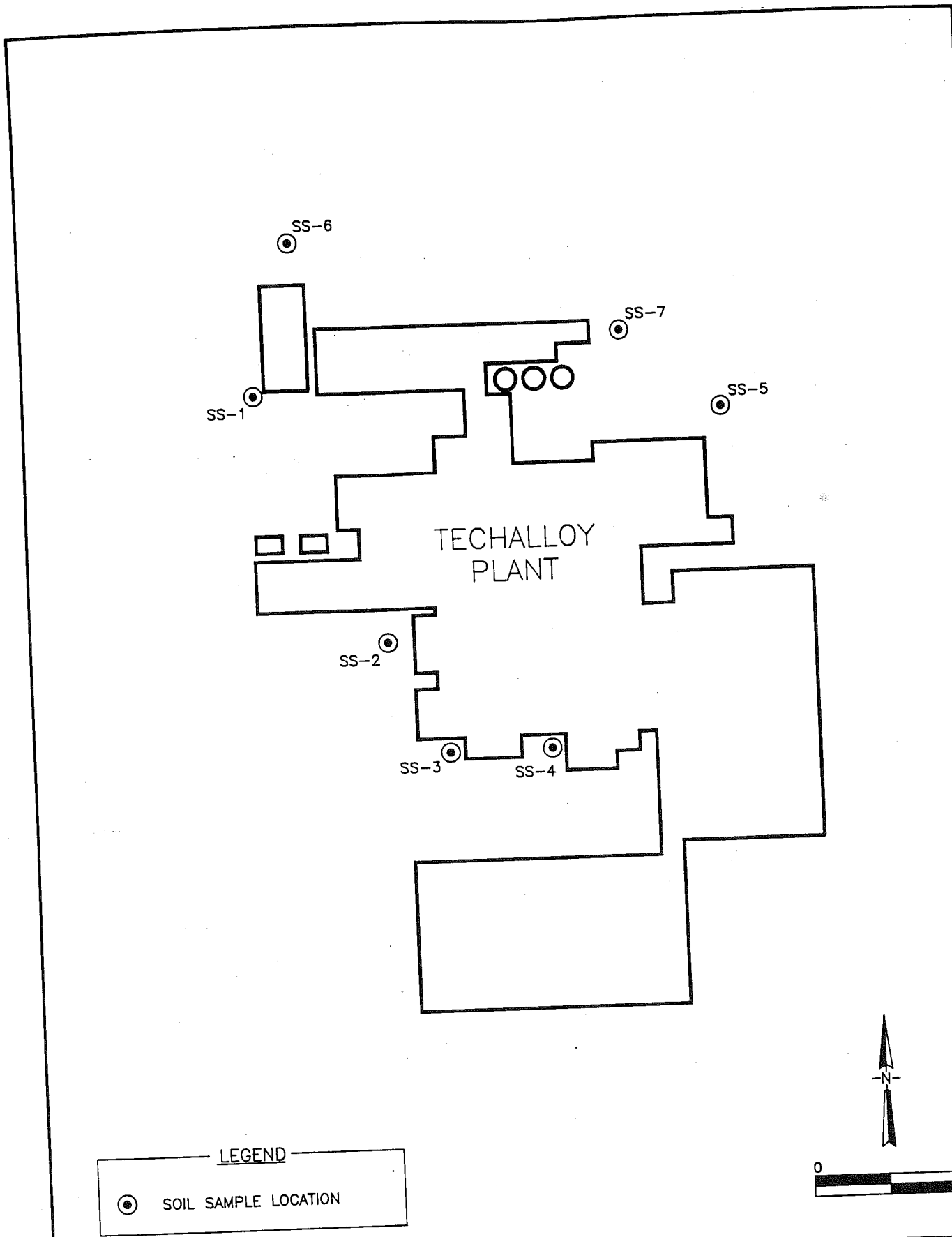
2.1.1 Soil Sample Location Rationale

The seven soil sample locations were identified by Techalloy as previous chemical spill or release areas. These areas were selected to identify shallow subsurface contamination and help delineate potential source areas of groundwater contamination. The locations of these samples are depicted in Figure 2-1.

Soil sample SS-1 was collected at the northwest corner of the plant. The sample location was immediately adjacent to the western edge of the concrete slab, south of the acid treatment room. SS-1 was situated to determine if soils adjacent to the concrete slab had been potentially impacted by chemical releases on the slab. SS-1 was advanced to a depth of 3 feet below ground surface (BGS).

Soil sample SS-2 was collected south of the fine wire building and west of the heavy wire building. The sample was collected immediately southwest of the cooling tank at a depth of 6 feet. SS-2 was situated to determine if soils in this areas had been potentially impacted by chemicals which may have been discarded out of the doorway in the west wall of the heavy wire building. SS-2 was advanced to 6 feet BGS to compensate for the additional 3 feet of fill added when the cooling tank was installed.

Soil sample SS-3 was collected at the southwest corner of the heavy wire building. The location was adjacent to a concrete slab outside of a doorway in the south wall. SS-3 was situated to determine if soils in this area had been potentially impacted by chemicals which may have been discarded out of the doorway. SS-3 was advanced to a depth of 4 feet BGS.



Soil sample SS-4 was collected on the south side of the heavy wire building. The location was adjacent to a doorway in the west wall of a small, attached room. SS-4 was situated to determine if soils in this area had been impacted by chemicals discarded out of the doorway. SS-4 was advanced to a depth of 4 feet BGS.

Soil sample SS-5 was collected at the northeast corner of the plant. The location was adjacent to the fence line immediately north of gate number 2. SS-5 was situated to determine if soils in this area had been potentially impacted by previous plant activities. SS-5 was advanced to a depth of 5 feet BGS.

Soil sample SS-6 was collected north-northwest of the acid house. The location was identified by Techalloy as a former release area. SS-6 was situated to determine if soils in this area had been impacted. SS-6 was advanced to a depth of 5 feet BGS.

Soil sample SS-7 was collected east of the acid house and boiler room. The location was adjacent to the eastern edge of the concrete slab on the east side of the boiler room. SS-7 was situated to determine if soils in this area had been potentially impacted by releases on the slab. SS-7 was advanced to a depth of 5 feet BGS.

2.1.2 Soil Sampling Methodology

WESTON subcontracted the sampling and analytical services of Tracer Research Corporation (TRC) of Tucson, Arizona, for the collection and analysis of the soil samples. The soil samples were collected by advancing decontaminated 3/4-inch diameter hollow steel pipes (probes). The probes were advanced to their designated depths using a hydraulic press mounted in the back of TRC's field van. The probes were advanced with an aluminum cone set in the tip to facilitate advancement, and prevent soil intrusion. After a probe was advanced just beyond the desired depth, the probe was raised off of the cone. The probe was then raised and lowered to fill the bottom section with soil. The probe was then retrieved from the hole, and a portion of soil was transferred directly to a pre-weighed 40-ml vial. The vial was weighed again to determine the mass of soil, and a predetermined amount of pure water was added. The vial was agitated and allowed to equalize for a few minutes. A portion of headspace was then drawn off with a syringe and injected into the gas chromatograph (GC) mounted in the TRC van.

2.1.3 Soil Sampling

Seven soil samples were collected and analyzed on site for 1,1,1-TCA, TCE, and PCE. These samples included one sample from each of the locations described in Subsection 2.1.1.

2.2 GROUNDWATER INVESTIGATION

The groundwater investigation was composed of two primary tasks:

- Evaluation of the horizontal, lateral, and downgradient extent of groundwater contamination via probe sampling and field analysis.
- Confirmation of field analysis via auger sampling and fixed laboratory analysis.

2.2.1 Groundwater Probe Sampling

The Phase II groundwater probe sampling locations were selected to delineate the horizontal, lateral, and downgradient extent of the contaminant plume, originating at the Techalloy facility.

2.2.1.1 Groundwater Probe Sampling Location Rationale

Groundwater probe sampling entailed the collection and analysis of 21 groundwater samples. Groundwater probe samples WS-1 through WS-21 were collected northwest of the Techalloy facility on February 12, 13, 14, 15, 28, and March 1, 1991. The locations of WS-1 through WS-21 are depicted in Figure 2-2. Previous monitoring well sample analyses at the Techalloy property boundary and the off-site well at Union and Highbridge Roads indicated that the contaminant plume had migrated off site in a northwesterly direction.

Probe samples WS-1 through WS-3 were located on a line running northeast-southwest through the northwest corner of the plant. These locations were selected to delineate the lateral extent of impacted groundwater near the Techalloy plant. WS-1 was located 70 feet west of the Olson Road and 480 feet south of the northern Techalloy property boundary. WS-2 was located 590 feet west and 590 feet south of WS-1, on the west side of the plant. WS-3 was located 290 feet west and 300 feet south of WS-1, immediately north of the acid house. *depth interval*

Probe samples WS-4 through WS-6 were located on a line running northeast-southwest through the northwest corner of the Techalloy property, and the property immediately to the north of Techalloy. These locations were selected to delineate the downgradient and lateral extent of impacted groundwater near the Techalloy property boundary. WS-4 was located 30 feet west of monitoring well MS-5. WS-5 was located 230 feet east and 200 feet north of MW-5. WS-6 was located 190 feet east and 290 feet north of WS-5. WS-5 and WS-6 were located on the property immediately north of the Techalloy property. WS-7 was also located on the property due north of Techalloy's. WS-7 was located 150 feet east of the western property boundary and 30 feet south of Highbridge Road.

2.2.2.1 Groundwater Auger Sampling Location Rationale

Groundwater auger samples TW-1 through TW-4 were situated within the plume boundary as delineated by TRC's analytical results. The sampling locations were situated to confirm the presence of the contaminant plume as delineated by TRC. The auger sample locations are depicted in Figure 2-2. The boring logs for TW-1 through TW-4 are attached as Appendix A.

TW-1 was located at the same location as TRC's WS-20, 1,350 feet north of O'Cock Road and 1,250 feet west of Union Road. TW-1 was located here to confirm the downgradient extent of the contaminant plume. TW-1 was advanced to a depth of 25 feet BGS.

TW-2 was located at the same location as WS-18, 740 feet north of O'Cock Road and 600 feet west of Union Road. TW-2 was located to compare analytical results between the field analysis and fixed lab analysis, at this location. TW-2 was advanced to a depth of 25 feet BGS.

TW-3 was located 250 feet north of Highbridge Road and 150 feet east of Union Road, on the property northeast of the intersection of the aforementioned roads. TW-3 was located to approximate the northeastern plume boundary at this location. TW-3 was advanced to a total depth of 87 feet BGS.

TW-4 was located at the same location as WS-10, 230 feet south of Highbridge Road and 155 feet west of the eastern boundary of the property immediately northwest of the Techalloy property. TW-4 was located to compare analytical results between the field analysis and fixed lab analysis at this location. TW-4 was advanced to a total depth of 82 feet BGS.

2.2.2.2 Groundwater Auger Sampling Methodology

WESTON subcontracted the drilling services of Exploration Technologies Incorporated (ETI) of Madison, Wisconsin. ETI advanced 4.25-inch inside diameter hollow-stem augers using a track-mounted CME 550 drilling rig. The lead auger advanced in each of the four borings was fitted with sections of heavy duty screen to facilitate the entry of water into the augers. At each of the four sampling locations (TW-1 through TW-4), the augers were advanced to 25 feet BGS. Groundwater was allowed to enter the augers for a period of time prior to the initiation of purging water from the augers. A minimum of three times the amount of water present in the augers was removed prior to groundwater sampling. The water was removed using a decontaminated disposable polyethylene bailer. After purging the augers, the groundwater was sampled with the bailer. Auger sample boreholes TW-3 and TW-4 were then advanced to approximately 65 feet BGS via mud rotary drilling. The drilling mud was then flushed from the borehole using clean potable water. A sand point was then advanced beyond the bottom of

the borehole to approximately 75 feet BGS. A Bernard Killman pump was inserted in the riser pipe of the sand point, and 175 gallons of water was purged from each boring prior to sampling. The groundwater sample was then collected by lowering a decontaminated disposable polyethylene bailer down to the sand point. After sampling both TW-3 and TW-4, standard 1.75-inch by 24-inch split spoons were advanced to identify the depth of the clay confining layer.

All groundwater samples collected from the auger borings followed the procedures outlined below:

- The augers were purged using a dedicated polyethylene bailer. Water was removed from just below the water surface to ensure that all stagnant water was evacuated.
- The boring was sampled using a disposable polyethylene bailer.
- The sample for VOC analysis was transferred into two 40-ml, laboratory-prepared septum vials. Each vial was overfilled, creating a convex meniscus to eliminate void space in the vial.
- The Teflon-lined caps were secured on the vials.
- The vials were inverted, tapped gently, and checked for bubbles. If bubbles were observed, the cap was removed, and the vial was overfilled as described in Step 3, then resealed. This step was repeated for each vial until a single-phase sample with no bubbles was obtained.
- Sample labels were attached to identify sample location, date, time, and analysis to be performed.
- Sample documentation, packaging, chain-of-custody, and shipment procedures were completed as specified in Subsections 2.3.1 and 2.3.2.
- Sealed plastic bags of ice were placed in each cooler to preserve the samples at 4° C.

All samples were collected by a WESTON geologist and transported directly to the laboratory via Federal Express overnight courier.

2.3 QA/QC PROCEDURES

2.3.1 Chain-of-Custody

WESTON chain-of-custody forms were filled out each day and included all samples collected on that day. This procedure was implemented to eliminate the possibility of manipulation and/or unknowing

contamination of the samples. The documentation also provides a tracking mechanism that lists or identifies personnel responsible for the sample from collection until its analysis. The following information was recorded on the chain-of-custody form: sample number, collector signature, date and time of collection, sample type (matrix), identification of the soil boring number, number of containers, parameters to be analyzed, signature of all persons involved in the chain-of-custody possession, and inclusive dates of possession.

2.3.2 Sample Preservation and Shipment

Groundwater samples were placed into containers as specified by Test Methods for Evaluating Solid Waste -- Physical/Chemical Methods (SW-846), 3rd Edition, 1987. All groundwater samples were preserved by cooling to 4° C. The samples were placed in coolers for transportation to the laboratory and packed such that no movement or breakage of the samples would occur during shipment. Sample containers were placed in plastic zip lock bags, and packing material was placed around the containers. Ice packs were placed over the samples, and the coolers were properly sealed and labeled according to the Department of Transportation (DOT) regulations.

2.3.3 Analytical Procedures

The analytical procedures used to determine the concentrations of constituents or parameters of interest were performed in accordance with U.S. EPA methods specified in SW-846.

2.3.4 Blanks and Duplicates

Specialized samples were collected in order to monitor the effects of sample collection, equipment decontamination, and storage and transportation on the sampling results. These included the following:

- Field Blanks. One field blank was collected by pouring deionized water through a decontaminated sampling instrument and transferring it to a laboratory-prepared sample container. These blanks were analyzed for the sample parameters required of the environmental samples collected with each device. Analysis of these samples determined whether cross contamination had occurred via the sampling device.
- Trip Blanks. These blanks originated in the laboratory and accompanied the sample containers through shipment, sampling, and shipment back to the laboratory. Two 40-ml septum vials were filled with ultra-pure (HPLC) water and analyzed for VOCs upon receipt of samples at the laboratory. These samples measured the impact of transportation on sample integrity.

- Laboratory Blanks and Sample Repreps. Blanks and sample reprep were run in the laboratory during sample analysis to ensure that the instruments had been cleaned properly and that "carry-over" had not occurred.
- One duplicate sample was collected. This sample was collected at a randomly selected sample location. The analysis of this sample demonstrates the reproducibility of analyses of the collected samples.

2.4 DECONTAMINATION PROCEDURES

The drill rig, augers, and rods were steam-cleaned prior to initiating any drilling activities and between borings.

Groundwater samples were collected using dedicated disposable equipment. Therefore, this equipment did not require decontamination between sampling locations.

SECTION 3

FIELD INVESTIGATION RESULTS

3.1 SITE STRATIGRAPHY AND HYDROGEOLOGY

Previous drilling activities on the Techalloy property, and the recent TW borings, have provided information on the subsurface soils at, and northwest of, the Techalloy property. The boring logs demonstrate that the Techalloy site, and the properties to the northwest, are underlain by fine to coarse sand and gravel, from just below ground surface to a silty clay till (Marengo Till) found at approximately 35 to 85 feet BGS.

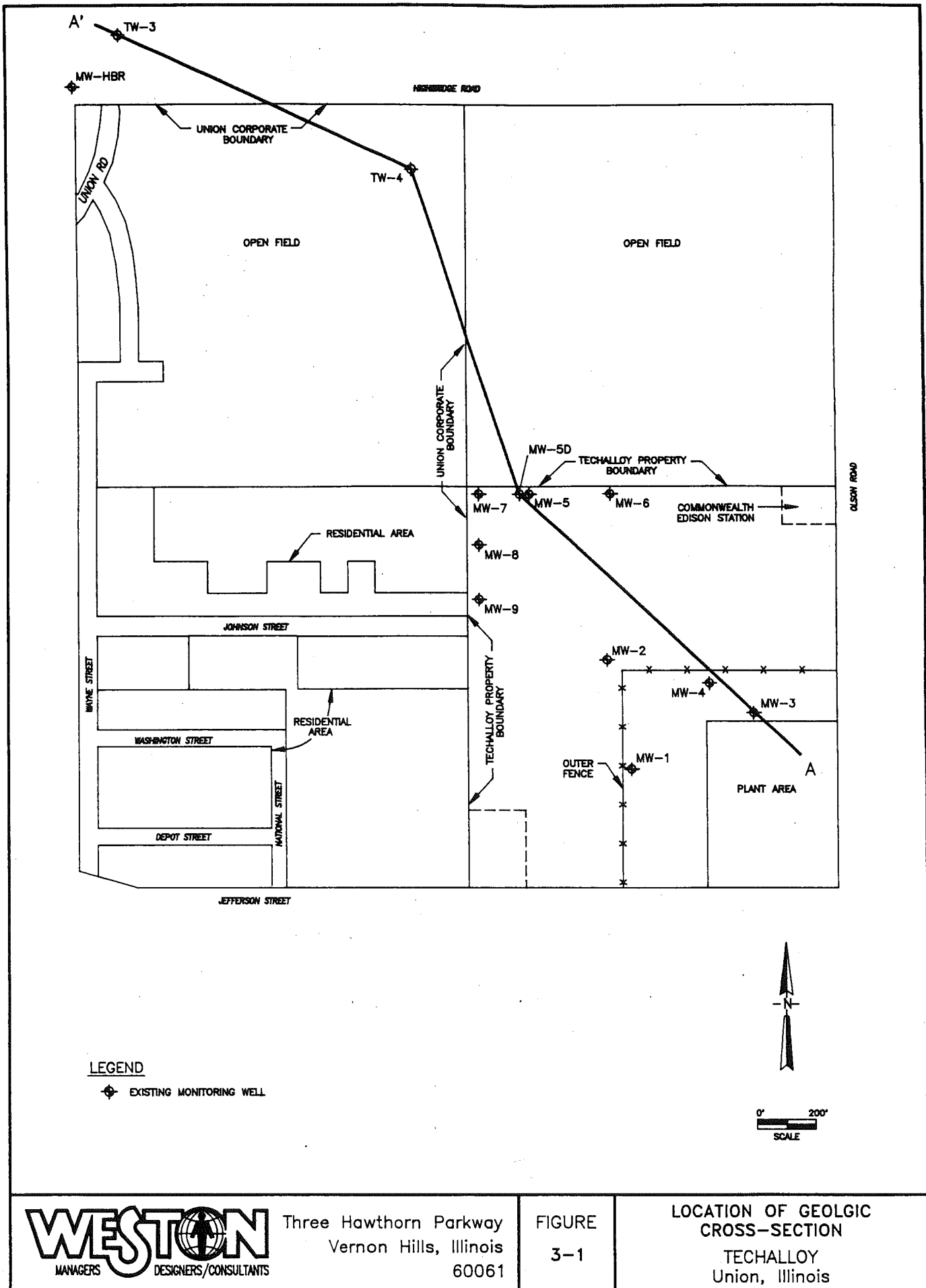
Using the geologic logs from wells MW-3 and MW-5D and the well logs from test wells TW-3 and TW-4, a geologic cross-section has been drawn. Figure 3-1 provides a trace map of the wells and test wells used to draw the cross-section. Figure 3-2 presents the geologic cross-section. At the facility, the silty clay layer is present at a depth of approximately 35 feet below the surface and drops in depth to approximately 85 feet below the surface to the northwest.

The sand and gravel unit is the underlying aquifer. Groundwater within this unit is flowing in a northwest direction. The silty clay unit is a confining layer which is approximately 80 feet thick at the area of the facility and is underlain by a shale bedrock. Within the area of the facility, the shale occurs at a depth of 114 feet below the surface.

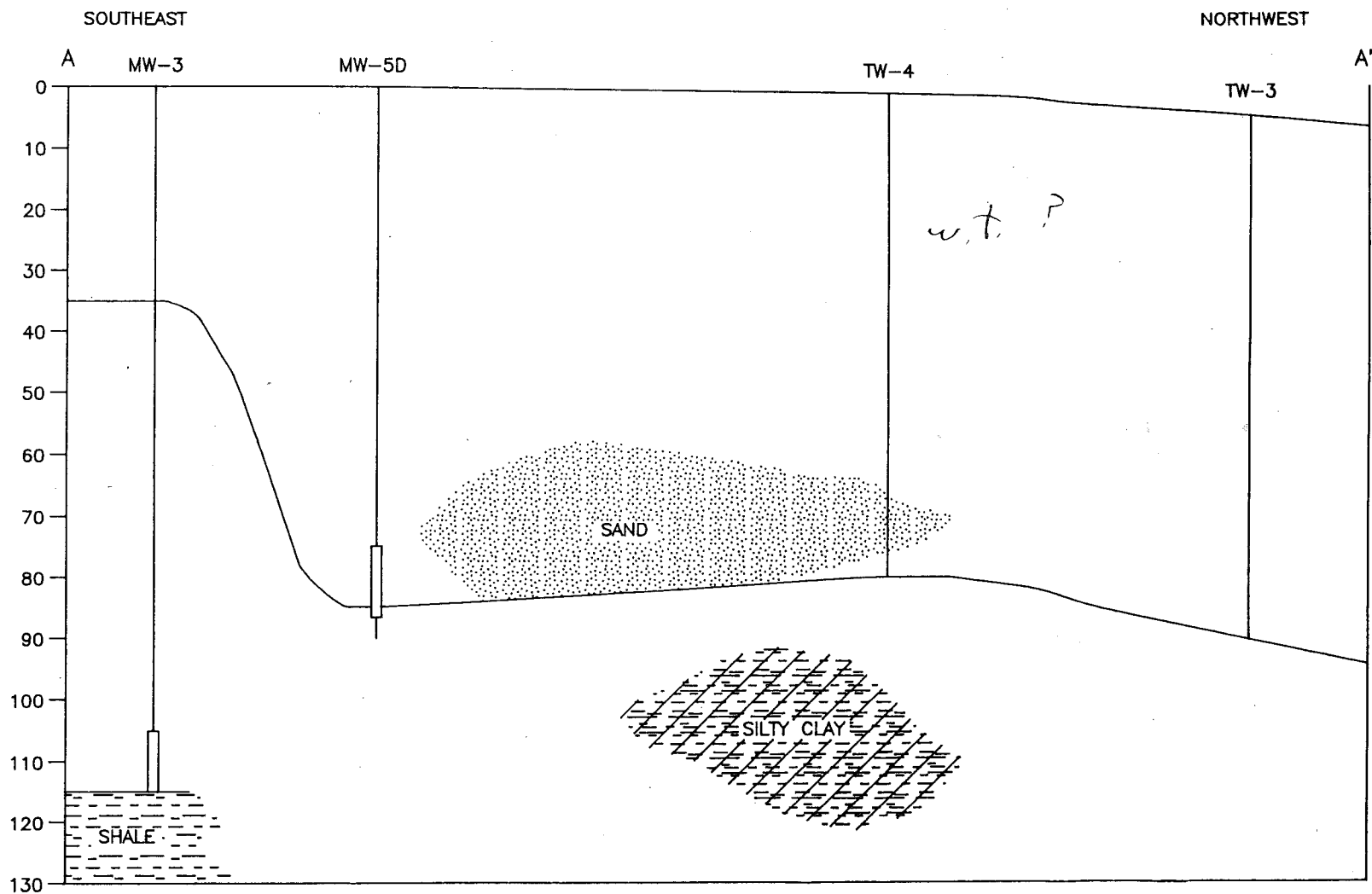
As stated above, the groundwater is migrating in a northwest direction (Figure 3-3). The hydraulic gradient between well MW-1 and MW-9 is 2.3×10^{-3} feet per foot. Using an estimated hydraulic conductivity of 1×10^{-2} cm/sec or 28.35 feet per day and an estimated porosity of 30 percent, a groundwater flow velocity is estimated at approximately 0.22 feet per day or 79 feet per year. It is emphasized that this is an estimated velocity using an estimated hydraulic conductivity and porosity value for a permeable sand and gravel aquifer.

3.2 ANALYTICAL RESULTS

The analytical results presented below have been evaluated by comparing the concentrations detected with those concentrations received from the Illinois Cleanup Objectives Team (COT) and Coordinated Permit Review Committee (CPRC). These concentrations received from the agency are cleanup objectives which have been presented to Techalloy in a letter dated 10 July 1990. Table 3-1 summarizes each of the parameters and standards.



3-3

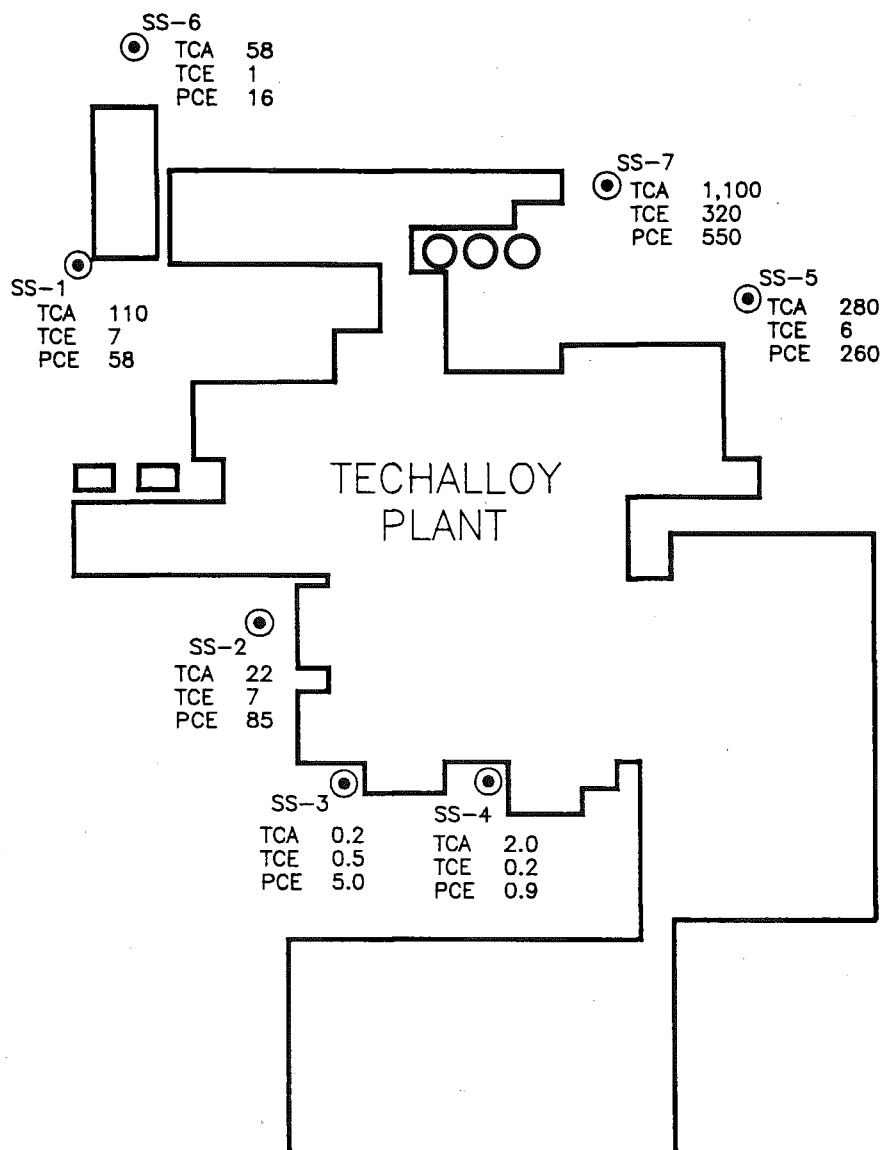


Three Hawthorn Parkway
Vernon Hills, Illinois
60061

FIGURE
3-2

GEOLOGIC CROSS-SECTION
TECHALLOY INC.
Union, Illinois

REV.

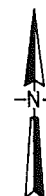


LEGEND

TCA = 1,1,1-TRICHLOROETHANE
TCE = TRICHLOROETHENE
PCE = TETRACHLOROETHENE

NOTE: ALL CONCENTRATIONS IN ug/Kg

● SOIL SAMPLE LOCATION



0 100'

Table 3-1
IEPA Techalloy Cleanup Objectives

Soil		
Parameter	Off Site (Class I) Soil (ug/kg)	On Site (Class II) Soil (ug/kg)
Methylene Chloride	5.0	25.0
1,1-Dichloroethylene	7.0	35.0
1,1-Dichloroethane	ND ⁷	ND
1,2-Dichloroethane	5.0	25.0
1,1,1-Trichloroethane	200.0	1000.0
Trichloroethylene	5.0	25.0
1,1,2-Trichloroethane	0.028	0.028
MIBK	0.35	0.35
Tetrachloroethylene	5.0	25.0
Arsenic	50.0 ⁶	200.0 ⁶
Lead	50.0 ⁶	100.0 ⁶
Groundwater		
Parameter	Off Site (Class I) Groundwater (ug/kg)	On Site (Class II) Groundwater (ug/kg)
Methylene Chloride	5.0	25.0
1,1-Dichloroethylene	7.0	35.0
1,1-Dichloroethane	ND	ND
1,2-Dichloroethane	5.0	25.0
1,1,1-Trichloroethane	200.0	1000.0
Trichloroethylene	5.0	25.0
1,1,2-Trichloroethane	0.028	0.028
MIBK	0.35	0.35
Tetrachloroethylene	5.0	25.0
Arsenic	50.0 ⁶	200.0 ⁶
Lead	50.0 ⁶	100.0 ⁶

ND - Not determined.

Cleanup standards are provided for both soil and groundwater. The Class I standards are for off-site locations, and the Class II standards are for on-site locations.

The cleanup objective standards have been compared with the concentration detected during this investigation. If a detected parameter exceeded the standard, it will be presented in the following discussion.

3.2.1 Soils

The seven soil samples collected around the Techalloy plant were analyzed for 1,1,1-TCA, TCE, and PCE by TRC using a GC mounted in the TRC field vehicle. A summary of the detected compounds is presented in Table 3-2. The areal distribution of 1,1,1-TCA, TCE, and PCE detections is presented in Figure 3-3.

1,1,1-TCA was detected in all seven soil samples analyzed. The soil sample SS-7, which was collected east of the acid house and boiler room, detected 1,1,1-TCA at a concentration of 1,100 $\mu\text{g}/\text{kg}$. This concentration exceeded the IEPA cleanup objective established for on-site soils. The IEPA on-site cleanup objective for 1,1,1-TCA is 1,000 $\mu\text{g}/\text{kg}$.

TCE was also detected in all seven soil samples analyzed. The soil sample SS-7 detected TCE at a concentration of 320 $\mu\text{g}/\text{kg}$. This detection exceeds the cleanup objective of 25 $\mu\text{g}/\text{kg}$ established for on-site cleanup.

PCE was also detected in all seven soil samples analyzed. The soil samples SS-1, SS-2, SS-5, and SS-7 detected PCE at concentrations of 58 $\mu\text{g}/\text{kg}$, 85 $\mu\text{g}/\text{kg}$, 260 $\mu\text{g}/\text{kg}$, and 550 $\mu\text{g}/\text{kg}$, respectively. Each of these detections exceeded the IEPA on-site cleanup objective of 25 $\mu\text{g}/\text{kg}$.

3.2.2 Groundwater Probe Samples

Groundwater probe samples collected on, and northwest of, the Techalloy property were also analyzed for 1,1,1-TCA, TCE, and PCE by TRC using the GC mounted in the TRC field vehicle. A summary of the detected compounds is presented in Table 3-3. The areal distribution of the water sampling (WS) locations and corresponding concentrations are presented in Figure 3-4.

1,1,1-TCA was detected at four TRC groundwater probe sampling locations at concentrations greater than the established IEPA cleanup objective for on-site and off-site groundwater. The 1,1,1-TCA on-site cleanup objective of 1,000 $\mu\text{g}/\text{L}$ was exceeded at probe sample locations WS-3, WS-4, and WS-8 on the Techalloy property; 1,1,1-TCA was detected at concentrations of 3,748 $\mu\text{g}/\text{L}$, 18,177 $\mu\text{g}/\text{L}$, and 206,131 $\mu\text{g}/\text{L}$, respectively. Approximately 1,200 feet downgradient and northwest of the Techalloy property, the IEPA

Table 3-2
Soil Probe Analytical Results
(All Concentrations in ug/kg)

Sample	Date	Depth (feet)	TCA	TCE	PCE
SS-1	2/13	3	110	7	58
SS-2	2/13	6	22	7	85
SS-3	2/13	4	0.2	0.5	5
SS-4	2/14	4	2	0.2	0.9
SS-5	2/14	5	280	6	260
SS-6	2/14	5	58	1	16
SS-7	2/14	5	1,100	320	550
<hr/>					
On-site standard			1,000	25	25
Off-site standard			200	5	5

Table 3-3
Groundwater Probe Analytical Results
(All Concentrations in ug/L)

Sample	Date	Depth (feet)	TCA	TCE	PCE
WS-1	2/12	10	0.74	0.95	0.004
WS-2	2/12	13	5.6	0.95	4.5
WS-3	2/12	9	3,748	381	754
WS-4	2/12	13	18,177	95	3,618
WS-5	2/12	7	0.18	0.95	1
WS-6	2/13	7	0.93	0.76	0.45
WS-7	2/13	10	0.74	0.76	0.45
WS-8	2/13	7	206,131	38	1,809
WS-9	2/14	7	0.93	0.57	0.6
WS-10	2/15	6	1,124	57	1,206
WS-11	2/28	7	56	1.9	15
WS-12	2/28	7	0.93	0.57	0.3
WS-13	2/28	9	1.3	0.57	4.5
WS-14	2/28	10	131	1.7	30
WS-15	2/28	7	0.37	0.57	0.15
WS-16	2/28	7	0.74	0.57	0.3
WS-17	2/28	8	0.74	0.19	0.15
WS-18	2/28	8	3.7	0.19	0.3
WS-19	3/1	8	75	11	0.75
WS-20	3/1	8	5.6	0.19	0.45
WS-21	3/1	8	1.4	0.19	0.15
On-site standard			1,000	25	25
Off-site standard			200	5	5

GEOLOGIC DRILL LOG				PROJECT NAME AND LOCATION Techalloy, Union, IL				PAGE NO. 1 of 1	HOLE NO. TW-4		
START 4/8/91	FINISH 4/9/91	DRILLER E.T.I.	DRILL METHOD 4.25 I.D. HSA	BOREHOLE DIAMETER 8"	WELL DIAMETER	TOTAL DEPTH 82.00'					
LOGGER S. Koepsell		TOP OF CASING ELEV.	GROUND ELEVATION	DEPTH/ELEVATION GROUNDWATER - DATE MEASURED '/							
SAMPLE NO.	SAMPLE TYPE	RECOVERY %	SAMPLE BLOWS*	ELEV	DEPTH	GRAPHIC LOG	WELL CONSTRUCTION	CLASSIFICATION	SAMPLE INTERVAL	DESCRIPTION	Hnu readings (in units) BZ: Breathing Zone BH: Borehole SP: Sample HS: Headspace
CT					5					<u>SILT LOAM:</u> some/and organics; friable; moist; black. <hr/> <u>SAND:</u> fine to coarse; trace fine gravel; moist; tan. wet at 8 feet.	
CT					10						
					15						
					20						
					25						
					30						<u>SAND:</u> fine to coarse; trace fine to medium gravel; moist; tan.
					35						
					40						
					45						
					50						
					55						
					60						
					65						
					70						
					75						
SS					80						<u>SILTY CLAY TILL:</u> trace fine to coarse sand and fine gravel; dense; moist; gray with pink staining. <hr/> End of boring at 87 feet.

*ASTM D1586 ST = SHELBY TUBE CS = CONTINUOUS SAMPLER

SS = SPLIT SPOON C = CORE BA = BUCKET AUG.

DD = DENNISON CT = CUTTINGS

Techalloy
Union, IL

PAGE NO.
1 of 1

HOLE NO.
TW-4

GEOLOGIC DRILL LOG				PROJECT NAME AND LOCATION			PAGE NO.	MOLE
				Techalloy, Union, IL			1 of 3	MW
START	FINISH	DRILLER	DRILL METHOD		BOREHOLE DIAMETER	WELL DIAMETER	TOTAL DEPT	
3/27/90	3/29/90	Layne-West.	4.25 I.D. HSA		8"	2" SST	90.00	
LOGGER		TOP OF CASING ELEV.	GROUND ELEVATION		DEPTH/ELEVATION GROUNDWATER - DATE MEASURED			
W.L. Niemann					6.25'/'			

Deep well at downgradient (North) property line.

SAMPLE NO.	SAMPLE TYPE	RECOVERY %	SAMPLE BLOWS	ELEV	DEPTH	GRAPHIC LOG	WELL CONSTRUCTION	CLASS-IFICATION	SAMPLE INTERVAL	DESCRIPTION	NOTES
01	SS	14	4		1			sm		SAND: very fine to medium, poorly sorted; some Silt; little fine gravel; medium dense; brown; moist.	
			8		2			sp			
					3						
					4						
					5						
02	SS	18	10		6			sm		SAND & GRAVEL: medium to coarse Sand, poorly sorted; fine to medium Gravel; medium dense; brown; wet.	
			11		7			sp			
			10		8			sw			
					9						
					10						
03	SS	18	10		11			sw		As above, fine to coarse Sand.	
			11		12						
			11		13						
					14						
					15						
04	SS	12	11		16			sp		SAND: fine to medium; well sorted; dense; brown; wet.	
			15		17						
			15		18						
					19						
					20						
05	SS	0	-		21			--		No recovery.	
			-		22						
			-		23						
			-		24						
			-		25						
06	SS	14	18		26			sw		SAND & GRAVEL: very fine to coarse Sand, very poorly sorted; fine Gravel; extremely dense; brown; wet.	
			34		27						
			82/4"		28						
					29						
					30						
07	SS	12	6		31			sp		SAND: very fine to medium, poorly sorted; some fine Gravel; dense; brown; wet. Bottom 2": Silt with trace fine Sand.	
			14		32			ml			
			35		33						
					34						
					35						
08	SS	18			36			ml		SILT: very well sorted; some very fine Sand; brown; wet.	
					37						
					38						
					39						
09	SS	14	20					sw		SAND & GRAVEL: very fine to coarse Sand, very poorly sorted; fine to medium Gravel; very dense; brown;	
			26								

*ASTM D1586 ST = SHELBY TUBE
SS = SPLIT SPOON C = CORE CS = CONTINUOUS SAMPLER

Techalloy

PAGE 11

GEOLOGIC DRILL LOG					PROJECT NAME AND LOCATION			PAGE NO.	WELL		
					Techalloy, Union, IL			2 of 3	MW-		
SAMPLE NO.	SAMPLE TYPE	RECOVERY %	SAMPLE BLOWS*	EL. FT.	DEPTH	GRAPHIC LOG	WELL CONSTRUCTION	CLASSIFICATION	SAMPLE INTERVAL	DESCRIPTION	NOTES
			30		41					wet.	
					42						
					43						
					44						
					45						
					46						
					47						
					48						
10	SS	18	15 56 50/4		49			sp		SAND: fine to coarse, poorly sorted; little fine Gravel; pounding rock; brown; wet.	
					50						
					51						
					52						
					53						
					54						
					55						
					56						
					57						
					58						
11	SS	4	24 30 48		59			sp		As above: very fine to fine; well sorted; pounding rock in slough material.	
					60						
					61						
					62						
					63						
					64						
					65						
					66						
					67						
					68						
12	SS	6	26 20 22		69			sw		SAND & GRAVEL: very fine to coarse Sand, very poorly sorted; fine to medium Gravel; dense; brown; wet.	
					70						
					71						
					72						
					73						
					74						
					75						
					76						
					77						
					78						
13	SS	6	55/6		79			sm gm		SAND & SILT: very fine to medium Sand, poorly sorted; some fine to medium Gravel; little Clay; gray to brown; wet.	
					80						
					81						
					82						
					83						

*ASTM D1586

SS = SPLIT SPOON

ST = SHELBY TUBE

C = CORE

CS = CONTINUOUS SAMPLER

Techalloy

Driller note in drill pres 82 feet (Cl)

PAGE NO.

GEOLOGIC DRILL LOG										PROJECT NAME AND LOCATION Techalloy, Union, IL		PAGE NO. 3 of 3	HOLE NO. MW-
SAMPLE NO.	SAMPLE TYPE	RECOVERY %	SAMPLE BLOWER	FILE #	DEPTH	GRAPHIC LOG	WELL CONSTRUCTION	CLASSIFICATION	SAMPLE INTERVAL	DESCRIPTION	NOTES		
14	SS	18	15 19 23		85 86 87 88 89 90			cl		SILT & CLAY: trace coarse Sand; trace fine Gravel; hard: gray: wet.			
										End of boring at 90 feet.			

*ASTM D1586 ST = SHELBY TUBE
 SS = SPLIT SPOON C = CORE CS = CONTINUOUS SAMPLER

Techalloy
 Union, IL

PAGE NO.
3 of 3

Well MW3

Well Construction Summary

Location or Coords: North of building
#2

Elevation: Ground Level _____
Top of Casing _____

Drilling Summary:

Total Depth 115.5'
Borehole Diameter 6.25"

Driller Layne Western

Rig Gus Pech
Bit(s) 4.25" ID HSA

Drilling Fluid NA

Surface Casing 8" protective casing

Well Design:

Basis: Geologic Log _____ Geophysical Log _____
Casing String(s): C = Casing S = Screen (Feet)

[illegible]

Casing: C1 2" PVC - 106'

C2.

Screen: S1 2" PVC - 10'
slot 0.01

S2.

Centralizers NA

Filter Material Flint sand - medium

Cement Portland type II

Other Bentonite - Wyoming

Construction Time Log:

Task	Start		Finish	
	Date	Time	Date	Time
Drilling:	1/12/91	1300	1/12/90	0017
Geophys. Logging:				
Casing:	1/13/90	0800	1/13/90	1200
Filter Placement:	1/13/90	1200	1/13/90	1300
Cementing:	1/13/90	1330	1/13/90	1430
Development:				
Other:				
Bentonite	1/13/90	1300	1/13/90	1330

Well Development:

Remove in excess of 5 volumes of
water. Water at end of developme
was clear.

Comments:

No split-spoon sample collected.
Soil cuttings were described and
suggested that sand ended at 35
feet clay extended to 114 feet.

WEST

GEOLOGIC DRILL LOG				PROJECT NAME AND LOCATION Techalloy, Union, IL		PAGE NO. 1 of 1	HOLE NO. TW-1
START 4/3/91	FINISH 4/3/91	DRILLER E.T.I.	DRILL METHOD 4.25 I.D. HSA	BOREHOLE DIAMETER 8"	WELL DIAMETER	TOTAL DEPTH 87.00'	
LOGGER S. Koepsell		TOP of CASING ELEV.	GROUND ELEVATION	DEPTH/ELEVATION GROUNDWATER - DATE MEASURED '/'			

SAMPLE NO.	SAMPLE TYPE	RECOVERY %	SAMPLE BLOWS*	ELEV	DEPTH	GRAPHIC LOG	WELL CONSTRUCTION	CLASSIFICATION	SAMPLE INTERVAL	DESCRIPTION	Hand readings (in units) BZ: Breathing Zone BH: Borehole SP: Sample HS: Headspace
	CT				5					SILT LOAM: some/and organics; friable; moist; black.	
					10					SAND: fine to coarse; trace fine gravel; moist; tan. wet at 8 feet.	
					15						
					20						
					25						
					30						
					35						
					40						
					45						
					50						
					55						
					60						
					65						
					70						
					75						
	SS				80					SAND: fine to coarse; trace fine gravel; few 1/4-inch silt beds; wet; tan.	
	SS				85					SILTY CLAY TILL: trace fine to coarse sand and fine gravel; dense; moist; gray with pink staining.	
										End of boring at 87 feet.	

GEOLOGIC DRILL LOG				PROJECT NAME AND LOCATION		PAGE NO.	HOLE NO.
START	FINISH	DRILLER	Techalloy, Union, IL		1 of 1	TW-2	
4/4/91	4/4/91	E.T.I.	DRILL METHOD	BOREHOLE DIAMETER	WELL DIAMETER		TOTAL DEPTH
LOGGER	TOP of CASING ELEV.	GROUND ELEVATION	4.25 I.D. HSA	8"	DEPTH/ELEVATION GROUNDWATER - DATE MEASURED		25.00'
S. Koepsell							

SAMPLE NO.	SAMPLE TYPE	RECOVERY %	SAMPLE BLOWS*	ELEV	DEPTH	GRAPHIC LOG	WELL CONSTRUCTION	CLASS-IFIFICATION	SAMPLE INTERVAL	DESCRIPTION	How readings (in units) BZ: Breathing Zone BH: Borehole SP: Sample HS: Headspace
CT										<p>SILT LOAM: some/and organics; friable; moist; black.</p> <p>SAND: fine to coarse; trace fine gravel; moist; tan. wet at 8 feet.</p> <p>End of boring at 25 feet.</p>	

GEOLOGIC DRILL LOG				PROJECT NAME AND LOCATION Techalloy, Union, IL			PAGE NO. 1 of 1	HOLE NO. TW-3
START 4/4/91	FINISH 4/8/91	DRILLER E.T.I.	DRILL METHOD 4.25 I.D. HSA	BOREHOLE DIAMETER 8"	WELL DIAMETER	TOTAL DEPTH 87.00'		
LOGGER S. Koepsell		TOP OF CASING ELEV.	GROUND ELEVATION	DEPTH/ELEVATION GROUNDWATER - DATE MEASURED '/'				

SAMPLE NO.	SAMPLE TYPE	RECOVERY %	SAMPLE BLOWS*	ELEV	DEPTH	GRAPHIC LOG	WELL CONSTRUCTION	CLASSIFICATION	SAMPLE INTERVAL	DESCRIPTION	How readings (in units) BZ: Breathing Zone BH: Borehole SP: Sample HS: Headspace
	CT				5					<u>SAND</u> : medium to coarse; moderately well sorted; moist; tan.	
	CT				10					<u>SILTY CLAY</u> : trace fine to coarse sand; cohesive; moist; black.	
					15					<u>SAND</u> : fine to coarse; trace fine gravel; moist; tan. wet at 8 feet.	
	CT				20						
					25						
					30					<u>SAND</u> : fine to coarse; trace fine to coarse gravel; moist; tan.	
					35						
					40						
					45						
					50						
					55						
					60						
					65						
					70						
					75						
					80					<u>SAND</u> : fine to coarse; trace fine gravel; few 1/4-inch silt beds; wet; tan.	
	SS				85					<u>SILTY CLAY TILL</u> : trace fine to coarse sand and fine gravel; dense; moist; gray with pink staining.	
										End of boring at 87 feet.	

GEOLOGIC DRILL LOG				PROJECT NAME AND LOCATION				PAGE NO.	HOLE NO.		
				Techalloy, Union, IL				1 of 1	TW-4		
START	FINISH	DRILLER	DRILL METHOD	BOREHOLE DIAMETER	WELL DIAMETER	TOTAL DEPTH					
4/8/91	4/9/91	E.T.I.	4.25 I.D. HSA	8"		82.00'					
LOGGER		TOP of CASING ELEV.	GROUND ELEVATION	DEPTH/ELEVATION GROUNDWATER - DATE MEASURED							
S. Koepsell				''							
SAMPLE NO.	SAMPLE TYPE	RECOVERY %	SAMPLE BLOWS*	ELEV	DEPTH	GRAPHIC LOG	WELL CONSTRUCTION	CLASSIFICATION	SAMPLE INTERVAL	DESCRIPTION	Hnu readings (in units) BZ: Breathing Zone BH: Borehole SP: Sample HS: Headspace
	CT				5					<u>SILT LOAM</u> : some/and organics; friable; moist; black. <hr/> <u>SAND</u> : fine to coarse; trace fine gravel; moist; tan. wet at 8 feet.	
	CT				25					<u>SAND</u> : fine to coarse; trace fine to medium gravel; moist; tan.	
	SS				80					<u>SILTY CLAY TILL</u> : trace fine to coarse sand and fine gravel; dense; moist; gray with pink staining. End of boring at 87 feet.	

*ASTM D1586 ST = SHELBY TUBE
 SS = SPLIT SPOON C = CORE CS = CONTINUOUS SAMPLER
 D = DENNISON CT = CUTTINGS BA = BUCKET AUG.

Techalloy
Union, IL

PAGE NO. HOLE NO.
 1 of 1 TW-4

APPENDIX 6-A
GEOLOGIC DRILLING LOG FORM

APPENDIX 7-A
SITE BACKGROUND

Health and Safety Plan Operating Procedures

Field Operating Procedure - Fld01 - NOISE PROTECTION

Noise is defined as unwanted sound. Noise can cause sudden traumatic hearing loss, long term more slowly occurring sensory-neural hearing loss which is irreversible, disruption of communication and masking of warning devices and alarms, increased stress levels and effects on the cardio-vascular and nervous systems. These latter two effects may occur at levels below that which cause damage to hearing and in situations where the conditions are more or less constant and daily.

OSHA regulations generally apply to 8 hour exposures and consider 85 dBA as an action level for a Hearing Conservation Program.

Where feasible, noise exposure will be controlled by engineering controls. Where high noise levels are encountered and where engineering controls are infeasible or until engineering controls can be accomplished, hearing protection devices will be used for worker protection from noise induced hearing loss.

Some of the sources of noise on hazardous materials, construction and industrial sites of a magnitude to cause hearing damage are: compressor motors, drill rig engine, hammer blows (from split spoon or other), compressor motors, compressed air, compressed water, and heavy equipment. The list is not all inclusive.

Any sound level surveys indicating noise levels of 85 dBA or above, or, in the absence of sound level measuring instrumentation, any noise/sound preventing normal vocal discussion between two individuals at arms length distance will dictate the need for hearing protection.

Hearing protection will be afforded by either disposable ear plugs or ear muffs. Administrative time control is not an acceptable method for preventing noise exposure since extreme noise for a short duration can cause severe, permanent hearing loss.

In addition to these protocols, WESTON's Hearing Conservation Program includes physical examination and audiometric testing during annual medical monitoring.

The selection, use, maintenance and control of hearing protection is further defined in the WESTON Personnel Protective Equipment Program.

Health and Safety Plan Operating Procedures

Field Operating Procedure - Fld02 - INCLEMENT WEATHER

HAZARD

Hot weather (ambient temperatures over 70° F), cold weather (ambient temperature levels below 40° F), rain, snow, ice and lightning are examples of inclement weather which may be hazardous or add risk to WESTON work activities. Heat Stress and cold stress are covered under separate Standard Procedures. Heat and cold stress must be identified as hazards in pre-project evaluations, listed as such in site specific HASP's with the Standard Procedures incorporated.

Heat, rain, cold, snow, ice and lightning are also inclement weather conditions which represent hazards and increased risk of performing WESTON work activities.

Extremes of heat, cold and humidity as well as rain, snow and ice affects monitoring instrument response and reliability, respiratory protection performance, and chemical protective clothing materials.

Heat

Heat stress is addressed in separate WESTON Standard Procedures. Heat represents additional hazards and increased risks. Hot dry weather increases risk of soil drying, erosion and dust dispersion which may represent or increase risk of exposure and environmental impact of a toxic hazards. Hot weather will increase pressure on closed containers and rate of volatilization, potentially increasing risk of toxic exposure or flammable/explosive atmospheres.

Rain, Wet Weather and High Humidity

Rain and wet conditions increase slipping and tripping hazards, braking distances of vehicles and chance of slippage of other braking devices on augurs, drills, etc. Rain fills holes and obscures trip and fall hazards and increases risk of electrical shock when working with electrical equipment. Rain changes soil conditions in trenching and excavating activities forming quicksand, weakening walls and increasing risk of cave-in. Vehicles become stuck in mud and tools slip on wet surfaces.

Cold, Snow and Ice

In addition to cold stress, which is covered in a separate Standard Procedure, cold weather affects vehicle operation by causing window frosting, increased difficulty of starting and braking. Ice and snow accumulates on windows and obscures vision.

Cold weather causes icing of roadways, driveways, parking areas, general work places, ladders, stairs and platforms which are wet.

Ice is not always as obvious as snow or rain and requires special attention.

Snow increases risk of slipping when walking, climbing steps and ladders, working at elevation and of accidents when driving vehicles or operating heavy equipment. Heavy snow may cause electric lines to sag or break and use of electric equipment in snow increases risk of electric shock. Snow hides pot holes and mud, which can result in vehicles getting stuck or persons falling when stepping onto or into hidden holes. Snow also may cover water, drums or containers sharp metal or sticks which can cause falls or punctures.

Lightning

Lightning represents a hazard of electrical shock which is increased when working in flat open spaces, elevated work places or working near tall structures or equipment such as stacks, radio towers and drill rigs. Lightning has caused of chemical storage tank fires.

RECOGNITION AND RISK ASSESSMENT

There are few actual OSHA rules to apply to the conditions covered in this procedure, however, under the "General Duty Clause", they must be addressed in safety programs.

Heat, rain, cold, snow, ice and lightning are natural phenomena which complicate work activities and add or increase risk. In the planning stages of a project and safety plan, these elements must be considered as physical hazards. Risk assessment can be accomplished in part in the development stages of a project, by listing as possible the most likely conditions i.e. rain and lightning in late spring, summer and early fall or in lightning prone areas, cold snow and ice in winter, etc. but the true determination of risk must often be made on site by the Site Health and Safety Coordinator. It is important that the SHSC is alert to these hazards, does not take them simply as a matter of fact and has time to notice them.

The few OSHA regulations which apply to inclement weather conditions include:

- o Monitoring equipment and PPE must be maintained in proper working order and used according to manufacturers instructions.
- o Walkways, stairs, ladders, elevated workplaces and scaffold platforms must be kept free of mud, ice and snow,
- o Vehicles used in rain or cold weather must have windshield wipers and defrosters with windows kept clear of obstruction,
- o Equipment requiring Roll-Over Protection must have seat belts,
- o Containers of hazardous substance must be remotely opened if pressure is suspected.
- o Employees must be protected from airborne contaminants using Engineering Controls such as wetting dry soil to prevent particle dispersion and providing local ventilation to reduce volatile air contaminants to safe levels, or if engineering controls are infeasible, using prescribed PPE

Additional procedures for protection during inclement weather, include:

- o Required conformance with traffic laws, including maintaining speed within limits safe for weather conditions and wearing seat belts at all times.
- o Using a walking stick or probe to test footing ahead of persons walking where there is standing water or snow to protect the walker against stepping into pot holes or onto puncture hazards or buried containers or other potentially structurally unsound surfaces.
- o Prior to using vehicles or equipment in off-road work, walking the work area or intended travel way when puddles or snow may obscure pot holes, puncture hazards or buried containers or other potentially structurally unsound surfaces.
- o Arrange to have winches, come-alongs or other mechanical assistance available when vehicles work in areas where there is increased risk of getting stuck. Cable or rope and mechanical equipment used for pulling stuck vehicles must be designed for the purpose, of sufficient capacity for the load and be inspected regularly and before use to ensure safety. Manually pushing stuck vehicles is to be avoided.
- o Prior to working in areas or beginning projects in times when there is an increased likelihood of lightning or which increase the potential for lightning striking personnel, steps must be taken to predict the occurrence of lightning strikes, including:
 - o Checking with Client Management to determine if there is any pattern or noted conditions which predict lightning or if there are structures which are prone to lightning strikes. Arrange for client notification when there is increased potential for lightning activities. Ensure that clients include WESTON workers in lightning contingency plans.
 - o Monitoring Weather Reports.
 - o Noting Weather Changes and conditions which produce lightning
 - o Stopping work in open areas, around drill rigs or other structures which may attract lightning, on or in water and in elevated work places when lightning strikes are sighted or thunder is heard near a work site.

Much of the responsibility for protection from inclement weather hazards falls upon the SHSC. The SHSC must recognize the inclement weather hazards affecting site for which he is responsible and complete the pre site activity risk assessment when inclement weather occurs. The SHSC must recognize which weather conditions affect instrument and PPE function and constantly remind site workers of the effects and need for more careful attention to check-out, donning and Doffing and monitoring of function and integrity. The SHSC must make decisions on the proper safety procedures to use if work must continue or to stop work if the risk is too great. Corporate Health and Safety must be notified of all instances of need to stop work for safety reasons including inclement weather.

Health and Safety Plan Operating Procedures

Field Operating Procedure - Fld03 - HOT PROCESSES - STEAM

HAZARD

Steam may be present in many forms and circumstances in WESTON work. It is the hottest form of water and as such represents severe thermal burn hazard. It may condense and leave wet work surfaces and will displace oxygen in enclosed areas. The heat and high humidity associated with steam affect instrument and PPE function.

Manufacturing, Energy Production and Laboratory/Research facilities

Steam may be conveyed at high or low pressure in manufacturing, energy production and laboratory/research facilities. Exposed surfaces of lines are hot and represent thermal burn hazards from contact. Even line insulation can be hot if wet or otherwise damaged. Steam lines are often covered with asbestos containing materials which represents a corollary toxic hazard. Steam lines are prone to leakage and are often vented and may release steam suddenly and noisily. Steam at high or low pressure can very quickly cause severe burns. The noise from high pressure steam vents can startle workers causing them to slip and fall. Leakage from condensate traps or lines themselves can also represent slip and fall hazards. Steam lines are often enclosed in pipe runs, tunnels or are underground. These areas must be considered as potential confined spaces. Enclosed areas around steam lines or areas around large steam using equipment may also represent increased risk of heat stress.

Steam Cleaning Equipment

Steam is often used in equipment decontamination and may be used in site remediation. Steam cleaning equipment has the same hazards as facility steam lines in that there are hot surfaces to contact, the steam itself is a thermal burn hazard, steam cleaners are often augmented by high pressure and in enclosed areas steam may displace oxygen and increase heat stress risk.

RECOGNITION AND RISK ASSESSMENT

The presence of steam lines and use of steam equipment must be recognized at the onset of a project. Facility or appropriate utility management must be contacted before site work begins to determine whether there are steam hazards in WESTON work areas. At the earliest opportunity, work areas must be surveyed for the presence of all "utilities" including steam.

When steam hazards are identified, an assessment of risk of contact must be made and appropriate Safeguards added to the Safety Plan. This assessment must take into account the likelihood of surface contact, high pressure venting, accidental release, leakage and condensation, adequacy and type of insulation, elevation of ambient heat and presence of confined areas.

PREVENTION AND PROTECTION PROGRAMS

The most effective method of preventing exposure and protecting workers from adverse effects of exposure to steam or steam lines is use of engineering controls. Guards or barriers placed between workers and steam jets or lines and directing vents away from work areas to minimize chance of contact, placing drip pans or sumps and slip resistant grating under condensate traps and where condensation or leaks wet work area floors or walkways and ensuring wet work areas are dried to prevent slips and falls and ventilation to reduce heat stress and ensure adequate oxygen are examples of engineering controls.

WESTON work assignments, clients and work places do not always allow for the protection of workers from steam by engineering controls. Work often involves close proximity with utilities in the normal course of facilities, clients who need our support in implementing safety practices and facilities which due to time, spill, release, fire or explosion are not in ideal states of repair.

A most important element of the Health and Safety Plan for these instances is recognition and careful assessment of risk of exposure and communication to all workers of the sources and points of exposure and of appropriate protection protocols.

In these instance protection will in much part be afforded by use of personnel protection and good work practices.

Contact

Whenever possible, guards and barriers preventing contact with steam lines or equipment must be left in place and workers must not pass.

When it is necessary to remove guards or work in close proximity to steam lines or equipment, wearing work clothes with long sleeves and long pants legs, heat insulated work gloves and leather safety shoes or boots will reduce the risk of contact. Prior to beginning work near a steam line check for sign of leakage and have someone familiar with the lines or equipment point out potential leak points and any pressure vents. If steam lines are at or above eye level and subject to leakage or there are pressure vents, wearing of hard hats and face shields will reduce the risk of contact with hot surfaces as well as drips of hot water and steam sprays.

Steam Jennies and other steam cleaning equipment use steam and often high pressure to increase cleaning power and reduce liquid waste production. The bodies of steam jennies are hot and not well protected. Workers can also be exposed to steam at the cleaning nozzles. Workers must be trained in the proper use of and safety practices prior to being assigned to use steam cleaning equipment.

Safety practices to be included in the training are:

- o Avoid contact with the surfaces of the equipment
- o Always work so Steam spray is directed away from the body
- o Do not hold equipment being steamed
- o Wear appropriate Personal Protective Equipment, (kept dry)*
 - o Long sleeved and pant legged clothing (with rain gear)*
 - o Leather work safety boots (with rubber boots over)*
 - o Heat insulating gloves (with rubber gloves over)*
 - o Face Shield

* As Necessary

Steam equipment users must be cautioned that PPE will provide protection from incidental contact, but may not protect for prolonged periods.

High pressure systems can also cause bruising if directed at the body and can project particles able to penetrate PPE.

Slips and Falls

Steam may condense and fall or leak from steam lines and equipment forming puddles and making floors, stairs, ladders and platforms slippery. Steam cleaning will also produce wet working surfaces with increased risk of slip and fall hazards. These conditions must be identified in pre and preliminary site safety surveys and included in the physical hazard recognition portion of the Site Specific Health and Safety Plan. During the preliminary Site Safety Survey, the risk of employees having to work in areas where steam leakage or use occurs must be made and appropriate Safety procedures must be instituted including:

- o Drying wet surfaces immediately upon notice
- o Placing drip pans under vents or leaks to prevent water from accumulating in general work areas
- o Constructing sumps with slip resistant gratings, placing slip resistant mats or floor boards where leakage or use of steam results in wet work surfaces
- o checking ladders and stairs prior to ascending and descending and platforms prior to occupancy to identify the presence of slipping hazards and using extra caution
- o wear shoes or boots which are slip resistant in water, and if working in wet soil, have soles which will not accumulate mud and increase risk of slipping

Workers must be trained in recognizing these hazards and use of the appropriate protection. Workers must also be cautioned that in cold weather, steam can condense and the resultant water freeze often very imperceptible so tha climbing ladders and stairs as well as flat work surfaces become trecherous.

Asbestos

Steam lines and equipment, especially if older, are often insulated with asbestos containing material. Prior to working on steam equipment, determine by questioning knowledgeable people or testing whether insulation material contains asbestos. It is particularly important to determine if the material is friable (could be crumbled easily) and whether it has been damaged to the point where fibers may be released.

If it is determined that the insulation does contain asbestos or it can not be ruled out, work must proceed in strict conformance with WESTON procedures and OSHA regulations. The Industrial Hygiene or Asbestos Management Sections, must be consulted for guidance and the Site Specific Health and Safety Plan must be approved for work with asbestos by Corporate Health and Safety.

Noise

Steam equipment often has associated high noise levels and high pressure vents can suddenly produce very loud noises. High noise areas and presence of pressure vents must be identified in the pre and preliminary Site Safety survey. Workers must be alerted to the possible loud noise of vents and must be provided with appropriate hearing protection when noise levels exceed limits in accord with the WESTON Hearing Conservation Program.

Heat, High Humidity and Moisture

Steam equipment use will often increase the ambient air temperature and humidity adding to risk of heat stress. The potential for elevated heat levels must be identified in pre and preliminary site safety surveys and Heat Stress Prevention measures consistent with WESTON's Standard Safety Procedures must be instituted.

Workers must keep feet dry to prevent immersion or trench foot. See Heat and Cold Stress Prevention Procedures.

Heat, High Humidity and Moisture will affect the function and reliability of many monitoring instruments. Instruments must be used according to Manufacturers directions and appropriate response factors or pre conditioners applied. SHSC's must recognize when conditions will make instruments unusable. DSO's, RSO's or Corporate Health and Safety must be contacted when on-site instruments are determined to be unusable for any purpose.

Heat, high humidity and moisture will affect performance of respirators, particularly APR cartridges and canisters, and chemical protective clothing, making rubbery materials pliable and inelastic and penetrating seams of stitched coveralls. Workers must be alerted to increased likelihood of respirator and protective clothing break through. Inspection, doffing and donning procedures must be modified to take these effects into account.

Confined Spaces

Steam or heat from steam released in poorly ventilated areas may reduce oxygen levels and create a Confined Space situation. In the pre and preliminary site safety survey, areas where WESTON will work, which contain steam lines or other steam equipment must be assessed to ensure there is adequate ventilation to provide sufficient oxygen and determine whether WESTON's activities will add to the potential for decreased Oxygen levels.

If it can not be reliably ascertained that there will be adequate Oxygen, WESTON's Confined Spaces Entry procedures must be instituted.

Steam line galleries and underground steam line tunnels are considered confined spaces.

Health and Safety Plan Operating Procedures

Field Operating Procedure - Fld05 - Heat Stress Prevention and Monitoring

Heat stress may occur at any time work is being performed at elevated temperatures. Wearing of chemical protective clothing, which may result in decreasing natural body ventilation, increases the risk of heat stress.

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur, ranging from mild (such as fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement) to fatal. Because heat stress is one of the most common and potentially serious illnesses at hazardous waste sites, regular monitoring and other preventative measures are vital.

Site workers must learn to recognize and treat the various forms of heat stress. The best approach is preventative heat stress management. In general:

- o Have workers drink 16 ounces of water before beginning work, such as in the morning or after lunch. Provide disposable 4-ounce cups, and water that is maintained at 50 - 60°F. Urge workers to drink 1 to 2 of these cups of water every 20 minutes for a total of 1 to 2 gallons per day. Provide a cool area for rest breaks. Discourage the intake of coffee during working hours. Monitor for signs of heat stress.
- o Acclimate workers to site work conditions by slowly increasing workloads, i.e., do not begin site work activities with extremely demanding activities.
- o Provide cooling devices to aid natural body ventilation. These devices, however, add weight and their use should be balanced against worker efficiency. An example of a cooling aid is long cotton underwear which acts as a wick to absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing.
- o In extremely hot weather, conduct field activities in the early morning and evening.
- o Ensure that adequate shelter is available to protect personnel against heat as well as cold, rain, snow, etc. which can decrease physical efficiency and increase the probability of both heat and cold stress. If possible, set up the command post in the shade.
- o In hot weather, rotate shifts of workers wearing impervious clothing.
- o Good hygienic standards must be maintained by frequent changes of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

The following is a discussion of specific results of heat stress:

1.0 Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of heat regulating mechanisms of the body; the individual's temperature control system that causes sweating stops working correctly. Body temperature rises so high that brain damage and death will result if the person is not cooled quickly.

- o Symptoms - Red, hot, dry skin, although person may have been sweating earlier; nausea; dizziness; confusion; extremely high body temperature; rapid respiratory and pulse rate; unconsciousness or coma.
- o Treatment - Cool the victim quickly. If the body temperature is not brought down fast, permanent brain damage or death will result. Soak the victim in cool, but not cold water; sponge the body with cool water or pour water on the body to reduce the temperature to a safe level (102°F). Observe the victim and obtain medical help. Do not give coffee, tea, or alcoholic beverages.

2.0 Heat Exhaustion

Heat exhaustion is a state of very definite weakness or exhaustion caused by the loss of fluids from the body. The condition is much less dangerous than heat stroke, but it nonetheless must be treated.

- o Symptoms - Pale, clammy, moist skin; profuse perspiration and extreme weakness. Body temperature is normal, pulse is weak and rapid, breathing is shallow. The person may have a headache, may vomit, and may be dizzy.
- o Treatment - Remove the person to a cool, air conditioned place, loosen clothing, place in a head-low position and provide bed rest. Consult physician, especially in severe cases. The normal thirst mechanism is not sensitive enough to ensure body fluid replacement. Have patient drink 1 to 2 cups of water immediately, and every 20 minutes thereafter until symptoms subside. Total water consumption should be about 1 to 2 gallons per day.

3.0 Heat Cramps

Heat cramps are caused by perspiration that is not balanced by adequate fluid intake. Heat cramps are often the first sign of a condition that can lead to heat stroke.

- o Symptoms - Acute painful spasms of voluntary muscles, e.g., abdomen and extremities.
- o Treatment - Remove victim to a cool area and loosen clothing. Have patient drink 1 to 2 cups of water immediately, and every 20 minutes thereafter until symptoms subside. Total water consumption should be 1 to 2 gallons per day.

4.0 Heat Rash

Heat Rash is caused by continuous exposure to heat and humid air and aggravated chafing clothes. The condition decreases ability to tolerate heat.

- o Symptoms - Mild red rash, especially in areas of the body that come into contact with protective gear.
- o Treatment - Decrease amount of time in protective gear and provide powder to help absorb moisture and decrease chafing.

5.0 Heat Stress Monitoring and Work Cycle Management

For strenuous field activities that are part of on-going site work activities in hot weather, the following procedures shall be used to monitor the body's physiological response to heat, and to manage the work cycle, even if workers are not wearing impervious clothing. These procedures are to be instituted when the temperature exceeds 70°F.

- o Measure Heart Rate - Heart rate should be measured by the radial pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats/minute. If the HR is higher, the next work period should be shortened by 33%, while the length of the rest period stays the same. If the pulse rate still exceeds 110 beat/minute at the beginning of the next rest period, the following work cycle should be further shortened by 33%. The procedure is continued until the rate is maintained below 110 beats/minute.
- o Measure Body Temperature - When ambient temperatures over 90°, body temperatures should be measured with a clinical thermometer as early as possible in the resting period. Oral temperature (OT) at the beginning of the rest period should be shortened by 33%, while the length of the rest period stays the same. If the OT exceeds 99.6°F at the beginning of the next rest period, the following work cycle should be further shortened by 33%. The procedure is continued until the body temperature is maintained below 99.6°F.

- o Physiological Monitoring Schedule - The following Suggested Frequency of Physiological Monitoring Schedule for Fit and Acclimated Workers shall be used as a guideline:

<u>Temperature</u>	<u>(Level D)</u>	<u>(Level C)</u>
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°F (30.8°C-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°F-87.5°F (28.1°C-32.2°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°F-82.5°F (25.3°C-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°F-77.5°F (22.5°C-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

Measure the air temperature with a standard thermometer. Estimate fraction of sunshine by judging what percent the sun is out.

100% sunshine	=	no cloud cover	=	1.0
50% sunshine	=	50% cloud cover	=	0.5
0% sunshine	=	full cloud cover	=	0.0

Adjusted temp. = actual temp. + 13 X (% sunshine factor).

The length of work period is governed by Frequency of Physiology Monitoring. The length of the rest period is governed by physiological parameters (heart rate and oral temperature). For example, if an individual's heart rate exceeds 110 beats/minute at beginning of the rest period, that individual will remain on rest until his/her heart rate drops well below 110 beats/minute and the next work period (=duration of time before suggested physiology monitoring) is decreased by 33%.

Health and Safety Plan Operating Procedures

Field Operating Procedure - Fld06 -Cold Stress

Persons working outdoors in low temperatures, especially at or below freezing are subject to cold stress. Exposure to extreme cold for a short time causes severe injury to the surface of the body, or results in profound generalized cooling, causing death. Areas of the body which have high surface area-to-volume ratio such as fingers, toes, and ears, are the most susceptible.

Chemical protective clothing generally does not afford protection against cold stress. In many instances, it increases susceptibility. Chemical hazard site workers must learn to dress carefully to provide chemical protection and thermal insulation while not dressing so warmly that exercise or strenuous activity will result in heat stress.

Provisions must also be made for the fact that after physical activity and accumulation of body heat, sudden chilling during decontamination and rest breaks may increase susceptibility to colds, etc.

Two factors influence the development of a cold injury: ambient temperature and the velocity of the wind. Wind Chill Indices describe the chilling effect of moving air in combination with low temperature.

As a general rule, the greatest incremental increase in wind chill occurs when a wind of 5 mph increases to 10 mph. Additionally, water conducts heat 240 times faster than air; thus, the body cools suddenly when chemical-protective equipment is removed if the clothing underneath is perspiration-soaked.

1.0 Frostbite

Local injury resulting from cold is included in the generic term frostbite. Frostbite of the extremities can be categorized into:

- o Frost nip or incipient frostbite is characterized by sudden blanching or whitening of skin.
- o Superficial frostbite is characterized by skin with a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- o Deep frostbite is characterized by tissues that are cold, pale, and solid.

To administer first aid for frostbite:

- o Take the victim indoors and rewarm the areas quickly in water that is between 39°C and 41°C (102°F-105°F).
- o Give a warm drink - water, or juices not coffee, tea or alcohol. The victim must not smoke.
- o Keep the frozen parts in warm water or covered with warm clothes for 30 minutes, even though the tissue will be very painful as it thaws.
- o Then elevate the injured area and protect it from injury.

- o Do not allow blisters to be broken.
- o Use sterile, soft, dry material to cover the injured areas.
- o Keep victim warm and get immediate medical care.

After thawing, the victim should try to move the injured areas a little, but no more than can be done alone, without help. Seek medical attention as soon as possible.

NOTE:

- o Do not rub the frostbitten part (this may cause gangrene).
- o Do not use ice, snow, gasoline or anything cold on the frostbitten area.
- o Do not use heat lamps or hot water bottles to rewarm the part.
- o Do not place the part near a hot stove.

2.0 Hypothermia

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. Its symptoms are usually exhibited in five stages:

- o Shivering
- o Apathy, listlessness, sleepiness, and
- o (sometimes) rapid cooling of the body to less than 95°F.
- o Unconsciousness, glassy stare, slow pulse, slow respiration
- o Death

If hypothermia is suspected in any field personnel, move person to a warmer location until symptoms recede.

Health and Safety Plan Operating Procedures

Field Operating Procedure - Fld07 - WET FEET

Under both hot and cold conditions, wet feet can lead to serious problems. Trench Foot, Paddy Foot and Immersion Foot are foot ailments resulting from feet being wet for long periods of time and are similar in effect. In their more serious form, these ailments result in pain, skin loss and incapacitation.

Workers in wet conditions or when conditions result in sweating and feet becoming and remaining wet, must dry their feet and change socks regularly to avoid these ailments.

Health and Safety Plan Operating Procedures

Field Operating Procedure - Fld10 - MANUAL LIFTING AND HANDLING OF HEAVY OBJECTS

HAZARD

Improper lifting can result in cuts, pinches, crushing and serious back, abdomen, arm and leg muscle and joint injury.

Even "light" objects, lifted improperly, can contribute to injury causing cuts, and muscle injuries.

Cuts, Pinching and Crushing

Splinters, slivers and sharp edges on objects to be lifted can result in cuts. Heavy objects can pinch or crush fingers, toes, arms and legs between the object and nearby objects, walls, tables, counters, railings and obstructions or if dropped. Insects or other biological hazards on or under objects to be lifted can result in bites or scratches. Contamination of objects can lead to chemical or radioactive materials exposure.

Muscle and Joint Injuries

Muscle and joint injuries occur when objects to be lifted are too heavy or awkward, in restricted access areas or are lifted improperly.

Lifting tasks, which are awkward and repetitive, involving even light objects can lead to nerve and joint damage.

RECOGNITION AND HAZARD ASSESSMENT

The need for manual lifting must be identified as a physical hazard when project tasks specifically require manual handling or use of heavy equipment and safe lifting techniques, as follows, must be instituted.

o Plan any lifting task, noting:

- o Contact hazards - Check each object before lifting for presence of splinters, slivers, sharp edges or parts, cracks and loose joints, signs of biological hazards, chemical or radioactive material contamination.
- o Weight of object - Unless involved in weight training, recommended safe lifting weights for an average man or woman are 50 & 35 pounds respectively.
- o Size and shape of object - large and oddly shaped objects are more difficult to lift even within safe weight limits due to imbalanced center of gravity.
- o Area in which lifting is to be done - Check for pinch points such as other objects close by and that there is room for safe lifting.
- o Conditions under which lifting is to be accomplished - Check for wet or slippery surfaces. Also consider level of protection to be used and that level B or A protection may add up to 40 lbs to be lifted as well as restricting range of motion & adding to area restriction by increasing bulk.
- o Route to be traveled if lifting involves carrying - Check walking and working surfaces for slip and trip hazards, note ramps, changes on level of elevation, ladders or stairways which need to be negotiated.

PREVENTION AND PROTECTION PROGRAMS

- o Identify the potential for contact hazards on objects to be lifted before lifting. Check each object before lifting, remove any noted hazards as feasible, wear gloves (at a minimum cotton), leather or kevlar, chemical resistant, etc., depending on the nature of the hazard. Also wear safety boots, coveralls and chemical protection as appropriate.
- o Avoid contact with cracks or loose joints or cover if hands or body can come into contact to reduce hazards of pinching.
- o Workers must know their lifting limitations, plan lifting, keep themselves reasonably in shape and get help if uncertain that they can lift safely, and, Managers must plan and allow for safe lifting. Safe lifting takes time.
- o Lifting an object from the floor
 - o determine that object is within safe weight limit,
 - o check for contact hazards,
 - o check floor for slip hazards,
 - o check that there is ample space between the object to be lifted and other objects to avoid pinching or crushing,
 - o check that there is ample room to squat, lift, turn or maneuver without twisting the back or other muscles or joints,
 - o walk the intended route of travel to identify, and remove slip and fall hazards, if possible,
 - o identify changes in elevation, steps, ramps, stairs and ladders which must be negotiated,
- o To lift objects which are square or rectangular in shape or form:
 - o place one foot slightly in front of the other,
squat as close to the object as possible,
grasp one of the top corners away from the body and the opposite bottom corner closest to the body,
Tilt the object slightly away from the body, tilt forward at the hips, keep the back straight and tuck in the chin,
Test to be sure the object is loose from floor and will lift without snagging,
straighten the legs, keeping the back bone straight, pull the object into the body & stand up slowly and evenly without jerking or twisting, if turning or change of direction is required, turn with feet without twisting the torso and step in the direction to travel,
To set an object down, reverse the sequence, being sure not to trap the bottom hand between the object & the surface on which the object is set.

This system, at first feels and seems awkward. Workers must be trained and have the opportunity to use the system with lighter objects before performing heavy lifting. For other shaped objects, the only modification needed should be hand hold position.

When two or more persons are lifting, have a plan and set signals so lifting occurs simultaneously.

Do not carry objects in a manner which obstruct vision in line of travel and of feet and footing.

Carry objects so one hand is free for travel on stairs or there is unobstructed view of footing and two hands are free for travel on ladders.

MANUAL HANDLING OF HEAVY OBJECTS

HAZARD

Manual maneuvering or handling of heavy objects without actually lifting is often required on hazardous materials, RCRA facilities and Construction sites. This often involves moving drums or other containers. Manual handling of heavy objects, even when not actually lifting, can pose all of the hazards of lifting including, cuts, pinches, bruises, crushing, muscle and joint strain, hazardous material and biological hazard contact.

RECOGNITION AND RISK ASSESSMENT

The need for manual handling of heavy objects must be addressed in the planning stages of a project HASP. Drums and other containers which must be maneuvered, for access to information or sampling locations, which are inaccessible to mechanical handling equipment, require manual handling and special precautions. When handling of heavy objects does not actually involve lifting, workers can handle heavier objects, even those weighing several hundred pounds, safely if proper techniques are used. In many instances, the procedures involve balancing and taking advantage of the shape of the object.

PREVENTION AND PROTECTION PROGRAMS

Prior to performing manual handling, it must be determined that it can be done safely and that mechanical assistance is infeasible.

Mechanical equipment or assistance such as dollies, carts, come-alongs or rollers are to be used whenever possible. Mechanical assistance must be of proper size, have wheels sized for the terrain and be designed to prevent pinching or undue stress on wrists. Objects to be moved must be secured to prevent falling and properly balanced to prevent tipping.

The minimum protection for manual handling is heavy cotton or leather gloves, Safety boots and coveralls. Metatarsel guards, chemical protective clothing and metal mesh or kevlar gloves must be used as risk of heavy items falling, hazardous materials contact and sharp edges, splinters or slivers increases.

Workers must be aware of their handling capacities and work within their capacities.

Objects to be manually handled must be checked prior to beginning movement for contact hazards and ensure handling will not trap hands, arms legs or feet between the object and other objects, walls, or railings.

Round or cylindrical objects may be rolled if rolling will not damage the structural integrity. Rolling must be controlled by chutes, tag-lines or other means of limiting acceleration. Workers must not be positioned down hill from rolled objects. Use of the legs for pushing and tag-line control of rolled objects must be stressed.

Cylindrical objects, such as drums which must remain upright, are handled manually by slightly tilting the object using the legs for control and balancing the object on the bottom edge. The handler then walks beside the object, with the object tilted toward the body, positioning the hands on the top edge away from the body and moving so they do not cross, thus, maintaining the balance and a steady controlled forward motion. Motion must be controlled so that stopping walking and moving the hands will stop forward motion.

Prior to moving cylindrical objects in this way, the route of travel must be walked to identify and changes of elevation, pot holes or other obstructions which could cause the object to snag, tip or get out of control.

Flat, square or rectangular objects are most easily handled using make-shift rollers or skids to break the friction with the resting surface and pushing, using the legs.

APPENDIX 7-B

ADDITIONAL INFORMATION FOR PROTECTION AGAINST HAZARDS

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD22a - Heavy Equipment Operation - General

Related SPOPS: FLD23 - Cranes
FLD24 - Aerial Lifts/Manlifts
FLD34 - Utilities
FLD35a - Electrical Safety - General
FLD35b - Electrical Safety - High Voltage

Machinery and Mechanized Equipment Safety

A. General

Before any machinery or mechanized equipment is placed in use, it will be inspected and tested by a competent mechanic and certified to be in safe operating condition.

The employer will designate a competent person to be responsible for the inspection of all machinery and equipment daily and during use to make sure it is in safe operating condition. Tests will be made at the beginning of each shift during which the equipment is to be used to determine that the brakes and operating systems are in proper working condition.

Preventative maintenance procedures recommended by the manufacturer will be followed.

Any machinery or equipment found to be unsafe will be deadlined and its use prohibited until unsafe conditions have been corrected.

Inspections or determinations of road conditions and structures will be made in advance to assure that clearances and load capacities are safe for the passing or placing of any machinery or equipment.

Machinery and mechanized equipment will be operated only by designated personnel. Equipment deficiencies observed at any time that affect their safe operation will be corrected before continuing operation.

Seats or equal protection will be provided for each person required to ride on equipment.

Getting off or on any equipment while it is in motion is prohibited.

Machinery or equipment requiring an operator will not be permitted to run unattended.

Machinery or equipment will not be operated in a manner that will endanger persons or property nor will the safe operating speeds or loads be exceeded.

MACHINERY AND MECHANIZED EQUIPMENT SAFETY (Continued)

All machinery or equipment will be shut down and positive means taken to prevent its operation while repairs or manual lubrications are being done. Exemption:

Equipment designed to be serviced while running.

All repairs on machinery or equipment will be made at a location which will provide protection from traffic for repair persons.

Heavy machinery, equipment, or parts thereof which are suspended or held apart by slings, hoists, or jacks also will be substantially blocked or cribbed before personnel are permitted to work underneath or between them.

Bulldozer and scraper blades, end-loader buckets, dump bodies, and similar equipment will be either fully lowered or blocked when being repaired or when not in use. All controls will be in a neutral position, with the engines stopped and brakes set, unless work being performed on the machine requires otherwise.

Stationary machinery and equipment will be placed on a firm foundation and secured before being operated.

All points requiring lubrication during operation will have fittings so located or guarded to be accessible without hazardous exposure.

When necessary, all mobile equipment and the operating area will be adequately illuminated while work is in progress.

Mechanized equipment will be shut down prior to and during fueling operations. Closed systems, with automatic shut-off which will prevent spillage if connections are broken, may be used to fuel diesel powered equipment left running.

All towing devices used on any combinations of equipment will be structurally adequate for the weight drawn and securely mounted.

Persons will not be permitted to get between a towed and towing piece of equipment until the towing equipment has been stopped.

All equipment with windshields will be equipped with powered wipers. Vehicles that operate under conditions that cause fogging or frosting of windshields will be equipped with operable defogging or defrosting devices.

All equipment left unattended at night, adjacent to a highway in normal use, or adjacent to construction areas where work is in progress, will have lights or reflectors, or barricades equipped with lights or reflectors, to identify the location of the equipment.

Whenever the equipment is parked, the parking brake will be set. Equipment parked on inclines will have the wheels chocked or track mechanism blocked and the parking brake set.

MECHANICAL AND MECHANIZED EQUIPMENT SAFETY (Continued)

Lift trucks, stackers, etc., will have the rated capacity posted on the vehicle so as to be clearly visible to the operator. When auxiliary removable counterweights are provided by the manufacturer, corresponding alternate rated capacities also will be clearly shown on the vehicle. The ratings will not be exceeded.

Steering or spinner knobs will not be attached to the steering wheel unless the steering mechanism prevents road reactions from causing the steering handwheel to spin. When permitted the steering knob will be mounted within the periphery of the wheel.

All industrial trucks in use will meet the requirements of design, construction, stability, inspection, testing, maintenance, and operation, defined in ANSI B56.1, Safety Standards for Powered Industrial Trucks.

The installation of live booms on material and personnel hoists is prohibited.

The controls of loaders, excavators, or similar equipment with folding booms or lift arms will not be operated from a ground position unless so designed.

Personnel will not work or pass under the buckets or booms of loaders in operation.

Cranes and any other equipment used for lifting must be inspected as required and records of inspection must be maintained.

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD22¹ - Heavy Equipment Operation - Drill Rigs

Related SOPS: FLD23 - Cranes
FLD24 - Aerial Lifts/Manlifts
FLD34 - Utilities
FLD35a - Electrical Safety - General
FLD35b - Electrical Safety - High Voltage

Drill Rig Safety

WESTON will use the Drilling Safety Guide prepared by delegations of the Diamond Core Drilling Manufacturers Association and the National Drilling Contractors Association as published by the National Drilling Federation as the basic Safety Programs for all activities involving drill rigs or similar apparatus for the purpose of well installation or soil borings.

Copies of this document are available from Corporate Health and Safety.

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD23 - Cranes/Lifting Equipment

**Related SPOPS: FLD22 - Heavy Equipment Operation
FLD24 - Aerial Lifts/Manlifts**

Any piece of equipment used for lifting materials or personnel shall be used and maintained in strict accordance with manufacturers directions and applicable OSHA regulations.

Load Limits will be visibly posted on all lifting devices.

Only operators with demonstrated competence shall be permitted to operate lifting devices.

Lifting machinery and all elements of equipment involved in lifting or supporting loads must be inspected prior to use and at a minimum monthly. Inspections must be performed by a competent person and must be documented.

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD32 - Fire Extinguishers Required and requirements

Related SPOPSFLDs - FLD09 - Hot Work (Permits)
FLD21 - Explosives
FLD22 - Heavy Equipment Operation
FLD30 - Hazardous Materials Use and Storage
FLD31 - Fire Prevention/Protection/Response Plans
FLD36 - Welding, Cutting and Burning

Related SPOPSPRGs - PRG05B - Contingency Plans Fires and Explosions

FIRE EXTINGUISHERS REQUIRED AND REQUIREMENTS

Fire extinguishers appropriate in size and classification shall be present, readily accessible and ready for use in all areas where there is potential for fires.

Fire extinguishers must be used in conjunction with an emergency response or contingency plan.

Health and Safety Plans must identify number, type and location of all fire extinguishers related to a specific project

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD34 - Utilities

Related SPOPSFLDs - FLD02 - Excavating and Trenching
FLD03 - Hot Processes - Steam
FLD22a - Heavy Equipment Operation - General
FLD22b - Heavy Equipment Operation - Drill Rigs
FLD23 - Lifting Equipment Operation
FLD35a - Electrical Safety - General
FLD35b - Electrical Safety - High Voltage

A. Survey for and Identification of Utilities

Prior to beginning work on site or in or around facilities, or buildings or other structures which could be served by or connected to utilities, a search must be conducted by the SHSC, ideally in association with someone familiar with the facility to identify any overhead, underground and in-workplace utilities such as:

- o electrical lines and appliances,
- o gas lines,
- o pipelines,
- o steam lines,
- o water lines,
- o sewer lines, and
- o pressured air lines.

The location of any utility which could pose a risk to workers must be communicated to all workers during site safety indoctrination. Utilities should be marked or access otherwise restricted to avoid chance of accidental contact.

Utilities shall be considered "live" or active until a reliable source has documented them to be otherwise.

A. Overhead Utilities

1.0 Operations Adjacent To Overhead Power Lines

- o Overhead transmission and distribution lines will be carried on towers and poles which provide safe clearance over roadways and structures.
- o Clearances will be adequate for the movement of vehicles and for the operation of construction equipment.

Overhead or above ground electric lines shall be considered "live" or active until a reliable source has documented them to be otherwise.

Elevated work platforms, ladders, scaffolding, man-lifts, drill or vehicle superstructures shall be erected a minimum of 20 feet (The actual distance is dependant upon the voltage of the line) from overhead electrical lines until the line is de-energized, grounded or shielded and a competent electrician has certified that arcing can not occur between the work place or superstructure.

2.0 Other Overhead or In-Workplace Utilities

Workers must be instructed to use care in working under or around utilities to avoid hot surfaces, loud noises, pressured gases or air, leaking of pipelines, discharge of steam or hot liquids and must work to prevent accidental contact with or breakage.

B. Underground Utility Searches

No excavating, drilling, or boring shall be done until a thorough underground utility survey, conducted by knowledgeable persons or agencies has been made and it is found safe to begin.

Even when a search is completed, drilling, boring and excavation should commence carefully until past the depth at which such utilities are usually located.

All underground utilities shall be considered "live" or active until reliable sources demonstrate otherwise.

The SHSC is responsible for ensuring underground utility searches are performed and procedures are conformed with.

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD35a - Electrical Safety - General

Related SPOPSFLDs - FLD02 - Inclement Weather
FLD08 - Confined Spaces Entry
FLD25a - Portable Ladders
FLD25b - Fixed Ladders
FLD26a-d - All Forms of Scaffolding
FLD34 - Utilities
FLD35b - Electrical Safety - General
FLD38 - Hand and Power Tools

IV. Electrical Safety

Work areas shall be checked for the presence of high voltage and other hazardous electricity sources. Sources shall be labelled and work areas provided with shielding or located at sufficient distance from the sources to prevent contact or arcing to personnel or equipment.

Locate and ensure there will be no adverse contact with overhead utilities, prior to positioning or moving any elevated work platform or rig superstructure.

When high voltage electrical service is required for site or project activities, service shall be connected by certified electricians in accordance with all applicable local and National Electric Codes.

Ground Fault Circuit Interrupters shall be used in the absence of properly grounded circuitry or when portable tools must be used around wet areas.

Electric lines, cables and extension cords must be appropriately guarded and maintained in good condition.

No work will be done on electric lines or electrically activated equipment, until the verification that service has been de-energized and/or the system has been locked and tagged out and each worker doing the work has sole possession of a key to a lock on the lock-out hasp.

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD35b - Electrical Safety - High Voltage

Related SPOPSFLDs - FLD02 - Inclement Weather
FLD08 - Confined Spaces Entry
FLD25a - Portable Ladders
FLD25b - Fixed Ladders
FLD26a-d - All Forms of Scaffolding
FLD34 - Utilities
FLD35a - Electrical Safety - General
FLD38 - Hand and Power Tools

High Voltage

Whenever possible, electrical equipment and electric conductive equipment is guarded or de-energized as a means of engineering control. When it is necessary to work with or around energized power transmission equipment, and use of permanent guarding is infeasible, grounding and personnel protective equipment is required. Work must be done by personnel who have been specially trained to work around High Voltage Electricity.

- (1) Live line work or work within the specified safe distances established by Table V-1, 29 CFR 1926.950 must be performed by qualified, competent people
- (2) Electrical personnel protective equipment must be non-conductive rubber material with electrical and mechanical protection equal to or better than rubber.

Rubber protective equipment must be in accordance with ANSI J6 series of Standards. For:

- o rubber insulated gloves (J6.6);
- o Rubber matting for use around electric equipment (J6.7);
- o Rubber insulated blankets (J6.4);
- o Rubber insulated hoods (J6.2);
- o Rubber insulated line hose (J6.1); and
- o Rubber insulated sleeves (J6.5)

Rubber or equivalent protective equipment must be:

- o visually inspected by a competent person before each use.
- o air tested before each use.
- o laboratory retested periodically, and
- o stored so sunlight or folding will not cause damage or deterioration.

Field Operating Procedure - FLD35b - Electrical Safety - High Voltage (Continued)

- (3) Hard hats worn around electrical hazards must be Classed "B" according to ANSI Standard Z89.2.
- (4) Body belts, lanyards and lifelines used around electrical hazards must be able to:
 - o withstand an A.C dielectric test of not less than 25,000 volts per foot "dry" for 3 minutes without visible signs of deterioration;
 - o allow less than one (1) milliamperage leakage when 3000 volts potentiation is applied 12 inches apart.
- (5) Hot line tools must be able to withstand voltages of 100,000 volts per foot if fiberglass or 75,000 volts per foot if wood.

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD36 - Welding/Cuting/Burning

Related SPOPS:

- FLD01 - Noise**
- FLD02 - Inclement Weather**
- FLD08 - Confined Spaces**
- FLD09 - Hot Work**
- FLD10 - Heavy Manual Lifting/Moving**
- FLD11 - Housekeeping**
- FLD16 - Compressed Gases**
- FLD22a - Heavy Equipment Operation**
- FLD24 - Aerial Lifts/Manlifts**
- FLD29 - Materials Handling**
- FLD30 - Hazardous Materials Use/Storage**
- FLD31 - Fire Prevention/Response Plan Required**
- FLD32 - Fire Extinguishers Required**
- FLD34 - Utilities**
- FLD35a - Electrical Safety - General**
- FLD35b - Electrical Safety - High Voltage**
- FLD38 - Hand and Power Hand Tools**

Welding, cutting and burning shall be performed only by those persons competent by reason of formal training or documented experience.

In addition to the above related Physical Hazard Safety Procedures the following procedures must be followed:

Any piece of equipment used for lifting materials or personnel shall be used and maintained in strict accordance with manufacturers directions and applicable OSHA regulations.

Load Limits will be visibly posted on all lifting devices.

Only operators with demonstrated competence shall be permitted to operate lifting devices.

Lifting machinery and all elements of equipment involved in lifting or supporting loads must be inspected prior to use and at a minimum monthly. Inspections must be performed by a competent person and must be documented.

PROTECTION OP
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PRESSURE WASHING

1 Introduction and Definition of Pressure Washing

High pressure water washing (or cleaning, jetting) is defined as the use of high pressure water, with or without the addition of other liquids or solid particles, to remove unwanted matter from various surfaces, where the pressure of the liquid jet exceeds 1000 PSIG at the orifice (or nozzle). The lower limit of 1000 PSIG does not mean that pressures below 1000 PSIG cannot cause injury or require any less attention to the principals of these recommended practices. Adequate precautions, similar to those of these recommended practices, are required at all pressures. As a guideline, these recommended practices are applicable where the product of pressure times flow exceeds 2000 PSI GPM.

This Protection OP provides only minimum generalize requirements. In addition the equipment manufacturer's manual should be read and followed.

2 Pressure Washing Equipment Requirements

2.1 Automatic pressure relief

The system shall be equipped with an automatic pressure relief device on the discharge side of the pump, adjusted so that the manufacturer's maximum allowable system pressure is not exceeded.

2.2 Pressure Gage

The system shall be equipped with a gauge to indicate the pressure being developed.

2.3 Electrical Controls

All electrical controls shall be either fail safe, 120 volt or protected with an approved ground fault circuit interrupter.

3 Personnel Protection Equipment

3.1 Each operator shall wear, as a minimum, the following personnel protection equipment. Additional equipment may be necessary if chemical or other hazards are present.

- a. Whole Body: Liquid resistant suits.
- b. Head: Hard hat.
- c. Eyes and Face: Face shield
- d. Foot: Water proof steel toe boots. And metatarsal guard should be built into boots or provided separately.
- e. Hearing: Ear plugs

**PROTECTION OF
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PRESSURE WASHING**

4 Operator Training

4.1 Only trained (experienced) personnel shall operate high pressure washing equipment, and supervise the training of new operators. Where equipment is rented or newly purchased and no one on the project team has prior experience with this equipment the vendor shall be required to provide training in the proper use of the equipment.

4.2 Training shall include as a minimum the following:

- a. Cutting Action - Cutting action and potential hazard to the human body shall be demonstrated through the use of the equipment (cut through a piece of lumber, concrete block, etc.)**
- b. Personnel Protection Equipment - The minimum required personal protection equipment shall be explained.**
- c. System Operation - The operation of the system shall be explained pointing out potential problems and proper corrective action.**
- d. Control Devices - The operation of all control devices shall be explained, particularly pressure control and relief devices. The importance of not tampering with control devices as well as the importance of keeping them functional shall be stressed.**
- e. Hose - The proper method of connecting hoses including laying out without kinks, protection from excessive wear and proper methods for using couplings and fittings shall be explained.**
- f. Stance - The proper stance for sound footing shall be demonstrated.**
- g. Proficiency - Personnel being trained shall demonstrate this knowledge in the safe use of the equipment through practical application under the direction of the trainer.**

PROTECTION OF
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PRESSURE WASHING

5 Injuries - Special Hazard

5.1 Injuries caused by the impact of a water jet may appear insignificant and give little indication of the extent of the injury beneath the skin and the damage to deeper tissues. Large quantities of water may have punctured the skin, flesh and organs through a very small hole that may not bleed.

5.2 Immediate hospital attention is required and medical staff must be informed of the cause of the injury. To insure this is not overlooked, medical staff should be advised that in previous cases of water jet punctures, unusual infection with micro-aerophilic organisms occurring at low temperatures have been reported. These may be gram negative pathogens such as are found in sewage. Bacterial swabs and blood cultures may be therefore be helpful.

6. Operational Rules

6.1 Never operate the equipment above the manufacturer's rated pressure maximum.

6.2 Increase pressure slowly until required working pressure reached.

6.3 Always rope of area to be cleaned

6.4 Never point nozzle at a person. Remember that a water jet can puncture splash suits and other personal protection gear.

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD38 - Hand and Power Hand Tools

Related SPOPS: FLD01 - Noise
FLD02 - Inclement Weather
FLD08 - Confined Spaces
FLD09 - Hot Work
FLD10 - Heavy Manual Lifting/Moving
FLD11 - Housekeeping
FLD16 - Compressed Gases
FLD22a - Heavy Equipment Operation
FLD24 - Aerial Lifts/Manlifts
FLD29 - Materials Handling
FLD30 - Hazardous Materials Use/Storage
FLD31 - Fire Prevention/Response Plan Required
FLD32 - Fire Extinguishers Required
FLD34 - Utilities
FLD35a - Electrical Safety - General
FLD35b - Electrical Safety - High Voltage
FLD38 - Hand and Power Hand Tools

Work with other than the simplest non-powered hand tool shall be performed only by those persons competent by reason of formal training or documented experience.

In addition to the above related Physical Hazard Safety Procedures the following procedures must be followed:

XV. HAND AND POWER TOOLS SAFETY

Unsafe hand tools shall not be issued or used. All hand tools will be kept in good repair and used only for the purpose for which they were designed. Wrenches with sprung jaws where slippage could occur, impact tools with mushroomed heads and wooden handled tools with cracks or splinters are examples of unsafe hand tools.

Tools having defects that will impair their strength or render them unsafe will be tagged or made inoperable and removed from service.

Guards must be in place during operation on all power tools designed to accommodate them. Guards and safety devices must remain in place on power tools unless removed according to manufacturers instruction for maintenance by a competent person and must be replaced before use. Belts, gears, shafts, drums, fly wheels, chains or other rotating, reciprocating or moving parts exposed to employee contact or representing other hazard must be guarded.

Proper PPE must be used when operating power tools or hand tools which may produce projectiles, cuts or abrasions, dusts, fume, mists or light or which pose a risk of harm to arms, legs, or feet if dropped.

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD38 - Hand and Power Hand Tools (Continued)

Throwing tools or materials from one location to another, from one person to another, or dropping them to lower levels, is not permitted.

Only nonsparking tools will be used in locations where sources of ignition may cause a fire or explosion.

Power tools will be inspected, tested, and determined to be safe for operation prior to use. Continued periodic inspections will be made to assure safe operating condition and proper maintenance.

Electric powered tools must be approved double insulated or grounded in accordance with 1926.404.

Rotating or reciprocating portable power tools will have a constant pressure switch that will shut off the power when the tool is released by the operator. A portable power tool may have a lock-or control provided turn-off can be accomplished by a single motion of the same finger or fingers that turned it on.

Hydraulic fluid used in powered tools will retain its operating characteristics at the most extreme temperatures to which it will be exposed.

Manufacturers' safe operating pressures for hydraulic hoses, valves, pipes, filters and other fittings will not be exceeded.

All hydraulic or pneumatic tools which are used on or around energized lines or equipment will have nonconducting hoses having adequate strength for the normal operating pressures.

Loose and frayed clothing, loose long hair, dangling jewelry, rings, chains, and wrist watches will not be worn while working with any power tool or machine.

All woodworking tools and machinery will meet applicable requirements of ANSI 01.1, Safety Code for Woodworking Machinery.

Extension cords:

- o Must meet UL or other rating criteria according to OSHA.
- o Use will be limited to essential tasks.
- o Must be tested for continuity before each use and must be connected to grounded outlets or ground fault current interrupters must be used.
- o Must be inspected daily for loose insulation, broken or missing plugs, bared wires, etc.
- o Grounding of outlets used for portable tools must be confirmed before use.
- o Must not be allowed to become tripping or slipping hazards.
- o Must not be used for lifting, tying off and shall be disconnected by pulling on the plug.

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD38 - Hand and Power Hand Tools (Continued)

Any piece of equipment used for lifting materials or personnel shall be used and maintained in strict accordance with manufacturers directions and applicable OSHA regulations.

Load Limits will be visibly posted on all lifting devices.

Only operators with demonstrated competence shall be permitted to operate lifting devices.

Lifting machinery and all elements of equipment involved in lifting or supporting loads must be inspected prior to use and at a minimum monthly. Inspections must be performed by a competent person and must be documented.

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD39 - Illumination

Related SPOPSFLDs - FLD08 - Confined Spaces Entry
FLD10 - Rough Terrain
FLD11 - Housekeeping
FLD13 - Neighborhood
FLD14 - Remote Areas
FLD18 - Using Boats
FLD22a-b - Heavy Equipment Operation
FLD23 - Lifting Equipment Operation
FLD33 - Demolition
FLD38 - Hand and Power Tools

VII. ILLUMINATION

Minimum lighting levels for general construction work areas is 5 foot-candles intensity. Recommended illumination levels for other tasks are listed below:

Foot-Candles	Area of Operation
5	General Construction Area Indoor: Warehousing areas, corridors, hallways, exits Tunnels, shafts and general underground work areas
10	Tunnel and shaft heading when drilling, mucking, scaling, General construction plant and shops
30	First Aid Stations, infirmaries and offices

Draft

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD41 - Standard Hand and Emergency Signals

Hand Signals

SIGNAL	MEANING
Hands on top of head.	Need assistance
Grip partners wrist or place both hands around partners arm.	Leave area immediately.
Thumbs up.	OK; I'm all right
Thumbs down	No; Negative
Hand gripping throat.	Cannot breath, out of air
Pointed finger on extended arm.	Look in that direction
Wave hands over head from side-to-side.	Attention; Stand-by for the next signal
Swing hand from direction of person receiving signal to directly overhead and through in circle.	Come here
Clenched fist of extended arm.	Stop motion
Draw index finger across front of throat.	Shut off engine; cut off power

Emergency Signals

SIGNAL	MEANING
One long sound of the emergency Alarm signal	Emergency situation, face Safety watch and watch or listen for direction
Pause; followed by:	
A number of short sounds, 1, 2, 3 or 4	Evacuate to the pre-designated emergency meeting place indicated by the number of sounds.

Geoprobe

MANUAL SECTION: Safety Instructions

INSTRUCTION TITLE: Safety Cautions

DATE: July 27, 1990

1. **Always** take vehicle out of gear and set emergency brake **before** engaging remote ignition.
- CAUTION: 2. If vehicle is parked on a loose or soft surface do not fully raise rear of vehicle with probe foot, as vehicle may fall or move, causing injury.
3. Always **EXTEND** the probe unit out from the vehicle and deploy the **FOOT** to clear vehicle roof line before folding the probe unit out.
4. Operators should wear OSHA approved steel toed shoes and keep feet clear of probe **FOOT**.
- CAUTION: 5. One person **only** should operate the probe machine and the assembly - disassembly of probe rods and accessories.
6. **Never** place hands on top of a rod while it is under the machine.
7. Turn off the hydraulic system while changing rods, inserting the hammer anvil, or attaching accessories.
8. Operator must stand to the control side of the probe machine, clear of probe foot and mast, while operating controls.
9. Wear safety glasses at all times during the operation of this machine.
10. Never exert down pressure on the probe rod so as to lift the machine base over six inches off the ground.
- CAUTION: 11. Never exert down pressure on a probe rod so as to lift the rear tires of the vehicle off the ground.
12. Always remove the hammer anvil or other tool from the machine before folding the machine to the horizontal position.
- CAUTION: 13. The vehicle catalytic converter is hot and may present a fire hazard when operating over dry grass or combustibles.
14. Geoprobe operators must wear ear protection. OSHA approved ear protection for sound levels exceeding 85 dba is recommended.
15. The location of buried or underground utilities and services must be known before starting to drill or probe.
16. Shut down the hydraulic system and stop the vehicle engine before attempting to clean or service the equipment.
- CAUTION: 17. Accidental engagement of this machine may cause injury.

APPENDIX 7-C

ADDITIONAL INFORMATION ABOUT CHEMICAL HAZARDS OF CONCERN

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS

**U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety and Health**

June 1990

For Sale by the Superintendent of Documents, U.S. Government
Printing Office, Washington, D.C. 20402

CAS No., UN No., and ID	Synonyms, trade names, and conversion factors	Exposure limits (TLV unless noted otherwise)	IDLH	Physical description	Chemical and physical properties		Incompatibilities and reactivities	Measurement method (See Table 1)	Personal protection and sanitation (See Table 3)	Recommendations for respirator selection — maximum concentration for use (MUC) (See Table 4)	Route	Symptoms (See Table 5)	Health hazards		Target organs (See Table 5)
					MW, BP, SOL, Fl.P., IP, Sp.Gr., Flammability	VP, FRZ UEL, LEL							First aid (See Table 6)		
1000 1000	1. Potassium cyanide, Potassium salt of hydrocyanic acid 2. Sodium cyanide, Sodium salt of hydrocyanic acid Synonyms of other com- pounds vary depending upon the specific com- pound	NIOSH C 5 mg/m³ (4.7 ppm) (10-min) OSHA 5 mg/m³	50 mg/m³	KCN & NaCN are white granular or crystalline solids with a faint almond-like odor. Synonyms of other com- pounds vary depending upon the specific com- pound	MW: 65.1/49.0 BP: 7/2725°F Sol: 77°F; 1173/1047°F F.P.: N/A IP: N/A Sp.Gr.: 1.55 (KCN)/1.60 (NaCN) Noncombustible Solids, but contact with acids releases highly flammable hydrogen cyanide.	VP: 0/0 mm (approx) MLT: 1173/ 1047°F UEL: N/A LEL: N/A	Strong oxidizers, such as acids, acid salts, chlorates & nitrates	Filter/Bub: KOH; ISE; III [#7904]	Clothing: Goggles: Wash: Change: Remove: Provide:	Any poss Any poss Immed contam After work if any poss contam Immed non-imperv contam Eyewash, quick drench	Inh Abs Ing Con	Asphy and death can occur; weak, head, cont, nau, vom; incr rate resp; irrit eyes, skin	Eye: Skin: Breath: Swallow:	Irr immed Soap wash immed Resp support Medical attention immed	CVS, CNS, liver, kidneys, skin
1	Formonitrile, Hydrocyanic acid, Prussic acid	NIOSH/OSHA ST 4.7 ppm (5 mg/m³) [skin]	50 ppm	Colorless or pale blue liquid or gas (above 71°F) with a bitter, almond- like odor	MW: 27.0 BP: 78°F Sol: Miscible F.P.: 0°F IP: 13.60 eV Sp.Gr.: 0.69 Class IA Flammable Liquid	VP: 630 mm FRZ: 8°F UEL: 40.0% LEL: 5.6%	Amines, oxidizers, acids, sodium hydroxide, calcium hydroxide, sodium carbonate, water, caustics, ammonia [Note: Can polymerize at 122-140°F]	Filter/Bub: KOH; ISE; III [#7904, Cyanides] [Note: Also Soda lime; Water: Vis: #6010]	Clothing: Goggles: Wash: Change: Remove: Provide:	Any poss Any poss Immed contam N.R. Immed wet (flamm) Eyewash, quick drench	Inh Abs Ing Con	Asphy and death at high levels; weak, head, cont; nau, vomit; incr rate and depth of respiration or respiration slow and gaspings	Eye: Skin: Breath: Swallow:	Irr immed Water flush immed Resp support Medical attention immed	CNS, CVS, liver, kidneys
cid)	Battery acid, Hydrogen sulfate, Oil of vitrol, Sulfuric acid (aqueous)	NIOSH/OSHA 1 mg/m³	80 mg/m³	Colorless to dark- brown, oily, odorless liquid. [Note: Pure compound is a solid below 51°F. Often used in an aqueous solution.]	MW: 98.1 BP: 554°F Sol: Miscible F.P.: N/A IP: ? Sp.Gr.: 1.84 (96-98% acid) Noncombustible Liquid, but capable of igniting finely divided combustible materials.	VP: 295°F; 1 mm FRZ: 51°F UEL: NA LEL: NA	Organic materials, chlorates, carbides, fuimnates, water, powdered metals [Note: Reacts violently with water with evolution of heat. Corrosive to metals.]	Si gel: NaHCO₃/ Na₂CO₃; IC; III [#7903, Inorganic Acids]	Clothing: Goggles: Wash: Change: Remove: Provide:	Any poss pH <2.5/Repeat pH >2.5 Any poss Immed contam N.R. Immed non-imperv contam pH <2.5: Eyewash, quick drench	Inh Ing Con	Irrit eyes, muc memb, skin; delayed pulm edema, pneumitis, bron; dental erosion	Eye: Skin: Breath: Swallow:	Irr immed Water flush immed Resp support Medical attention immed	Eyes, resp sys, skin, teeth
1 soln) 1 soln)	Aqua fortis, Engravers acid, Hydrogen nitrate, Red fuming nitric acid (RFNA), White fuming nitric acid (WFNA)	NIOSH/OSHA 2 ppm (5 mg/m³) ST 4 ppm 10 mg/m³ [Note: Often used in an aqueous solution. Fuming nitric acid is concentrated nitric acid that contains dissolved nitrogen.]	100 ppm	Colorless, yellow, or red fuming liquid with an acid, suffocating odor.	MW: 63.0 BP: 181°F Sol: Miscible F.P.: N/A IP: 11.95 eV Sp.Gr.: 1.50 Noncombustible Liquid, but increases the flammability of combustible materials.	VP: 48 mm FRZ: -44°F UEL: NA LEL: NA	Combustible materials, metallic powders, hydrogen sulfide, carbides, alcohols [Note: Reacts with water to produce heat. Corrosive to metals.]	Si gel: NaHCO₃/ Na₂CO₃; IC; III [#7903, Inorganic Acids]	Clothing: Goggles: Wash: Change: Remove: Provide:	Any poss >1%/Repeat <1% Any poss Immed contam N.R. Immed non-imperv contam >1%: Eyewash, quick drench	Inh Ing Con	Eyes, nose, throat irrit; palm edema, bron; empty; conj; stomatis; dental erosion; tracheobron; skin, eye burns; derm	Eye: Skin: Breath: Swallow:	Irr immed Water flush immed Resp support Medical attention immed	Resp sys, eyes, skin, teeth
1 ppm = 5.46 mg/m³	Ethylene trichloride, Triclene, Trichloroethane	NIOSH Ca See Appendix A 25 ppm OSHA 50 ppm (270 mg/m³) ST 200 ppm (1080 mg/m³)	Ca [1000 ppm]	Colorless liquid with a mild chloroform-like odor.	MW: 131.4 BP: 185°F Sol: 77°F; 0.1% F.P.: 90°F IP: 9.45 eV Sp.Gr.: 1.46 Class IC Flammable Liquid, but burns with difficulty.	VP: 58 mm FRZ: -99°F UEL: 77°F; 10.5% LEL: 77°F; 6%	Strong caustics & alkalis; chemically- active metals such as barium, lithium, sodium, magnesium, titanium & beryllium	Char: CS; GC/FID; III [#1022]	Clothing: Goggles: Wash: Change: Remove:	Repeat Reason prob Prompt wet N.R. Prompt non-imperv wet	Inh Ing Con	Head, vert; vis dist, tremors, som, nau, vom; irrit eyes; derm; card arrhy, pares; [card]	Eye: Skin: Breath: Swallow:	Irr immed Soap wash prompt Resp support Medical attention immed	Resp sys, heart, liver, kidneys, CNS, skin
1 ppm = 8.88 mg/m³	Perchloroethylene, Perchloroethylene, Perk, Tetrachloroethylene	NIOSH Ca See Appendix A Minimize workplace exposure concentrations; limit number of workers exposed. OSHA 25 ppm (170 mg/m³)	Ca [500 ppm]	Colorless liquid with a mild, chloroform-like odor.	MW: 185.8 BP: 250°F Sol: 77°F; 0.02% F.P.: N/A IP: 8.32 eV Sp.Gr.: 1.62 Noncombustible Liquid	VP: 14 mm FRZ: -2°F UEL: NA LEL: NA	Strong oxidizers; chemically-active metals such as lithium, beryllium & barium, caustic acids; sodium hydroxide; potash	Char: CS; GC/FID; III [#1003, Halo- genated Hydro- carbons]	Clothing: Goggles: Wash: Change: Remove:	Repeat Reason prob Prompt contam N.R. Prompt non-imperv contam	Inh Ing Con	Irrit eyes, nose, throat; nau; rash face, neck; vert, dizz, head; som; skin eryt; liver damage; [card]	Eye: Skin: Breath: Swallow:	Irr immed Soap wash prompt Resp support Medical attention immed	Liver, kidneys, eyes, upper resp sys, CNS
1 ppm = 5.55 mg/m³	Chloroethane, 1,1,1-Trichloroethane; 1,1,1-Trichloroethane (stabilized)	NIOSH C 350 ppm (1900 mg/m³) (15-min) OSHA 350 ppm (1900 mg/m³) ST 450 ppm (2450 mg/m³)	1000 ppm	Colorless liquid with a mild, chloroform-like odor.	MW: 133.4 BP: 185°F Sol: 0.4% F.P.: None IP: 11.00 eV Sp.Gr.: 1.34 Noncombustible Liquid, however the vapor will burn.	VP: 100 mm FRZ: -23°F UEL: 12.5% LEL: 7.5%	Strong caustics; strong oxidizers; chemically-active metals such as zinc, aluminum, magnesium powders, sodium & potassium; water [Note: Reacts slowly with water to form hydrochloric acid.]	Char: CS; GC/FID; III [#1003, Halo- genated Hydro- carbons]	Clothing: Goggles: Wash: Change: Remove:	Repeat Reason prob Prompt wet N.R. Prompt non-imperv wet	Inh Ing Con	Head, lass, CNS depres, poor equi; irrit eyes; derm; card arrhy	Eye: Skin: Breath: Swallow:	Irr immed Soap wash prompt Resp support Medical attention immed	Skin, CNS, CVS, eyes

OVA = 70% Response / HNu (11.7 eV) = High Response (assume 75%)

OVA = 70% Response / HNu (11.7 eV) - No Response Data Available

OVA = 105% Response / HNu (11.7 eV) = 90% Response

1977



EM SCIENCE

111 Woodcrest Road, Cherry Hill, New Jersey 08034-0396, Phone (809) 354-9200

REVISED

MATERIAL SAFETY DATA SHEET

Essentially Similar to U.S. Department of Labor Form OSHA-20

SECTION 1		NAME & PRODUCT	
Chemical Name: Potassium Dichromate		Catalog Number: PX1445, PX1450, #4865	
Trade Name & Synonyms: Dichromic Acid Dipotassium Salt		Chemical Family: Inorganic Salt	
Formula: $K_2Cr_2O_7$		CAS #7778-50-9	Formula Weight: 294.19
SECTION 2		PHYSICAL DATA	
Boiling Point, 760 mm Hg (°C)	500° decomp.	Specific Gravity (H ₂ O = 1)	2.676
Melting Point (°C)	398°	Solubility in H ₂ O, % by wt. at 20°C	11.7%
Vapor Pressure at 20°C	N/A	Appearance and Odor	Orange crystals
Vapor Density (air = 1)	N/A		
Percent Volatiles by Volume	N/A	Evaporation Rate (Butyl Acetate = 1)	N/A
SECTION 3		FIRE AND EXPLOSION HAZARD DATA	
Flash Point (test method)	Noncombustible	Flammable Limits	Lel N/A Uel N/A
Extinguishing Media Use media appropriate for surrounding material			
Special Hazards and Procedures Wear self-contained breathing apparatus and protective clothing.			
Unusual Fire and Explosion Hazards		Contact with finely divided oxidizable substances may cause explosion.	
SECTION 4		REACTIVITY DATA	
Stable X	Conditions to Avoid		
Unstable	Material is strong oxidizer. Avoid contact with combustible material and reducing agents.		
Materials to Avoid			
() Water () Acids () Bases () Corrosives () Oxidizers			
(X) Other (specify) combustibles, organic materials, reducing agents.			
Hazardous Decomposition Products		Chromium oxides, K ₂ O	
SECTION 5		SPILL OR LEAK PROCEDURES AND DISPOSAL	
Steps to be Taken in Case Material is Released or Spilled Take up and containerize for proper disposal.			
Waste Disposal Method		To be performed in compliance with all current local, state, and federal regulations	

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NFPA

PX1445, PX1450, #4863

SECTION 8**HEALTH HAZARD DATA**Threshold Limit Value, ACGIH: 0.05 mg/m³ (TWA) (as Cr)OSHA-PEL: 0.1 mg/cu. m. (CL) (as CrO₃)

TXDS: ori-chd LDLo: 26 mg/kg

ori-gpg LDLo: 163 mg/kg

Effects of Overexposure

Toxic by ingestion and inhalation. Contact may cause rash or external ulcers. Dust or solution spray inhalation may cause perforation of nasal septum. Ingestion causes stomach and kidney disorders. May be toxic by skin absorption. See also Section 10.

First Aid Procedures GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.

Skin: Wash thoroughly with soap and water.

Eyes: Flush thoroughly with water for at least 15 minutes.

Inhalation: Remove to fresh air.

Ingestion: Induce vomiting if patient is conscious.

SECTION 7**SPECIAL PROTECTION INFORMATION**

Ventilation, Respiratory Protection, Protective Clothing, Eye Protection

Material must be handled or transferred in an approved fume hood or with equivalent ventilation.

Protective gloves (Neoprene, PVC, or equivalent) must be worn to prevent skin contact.

Safety glasses with side shields must be worn at all times.

NIOSH-approved respirator should be worn in the absence of adequate ventilation.

SECTION 8**SPECIAL HANDLING AND STORING PRECAUTIONS**

Keep container closed when not in use. Do not store near, and avoid contact with, combustible materials. Store in a cool, well-ventilated area. Do not breathe dust. Do not get in eyes, on skin, or on clothing. Do not take internally. Wash thoroughly after handling.

SECTION 9**HAZARDOUS INGREDIENTS**

(refer to section 3 through 8)

None other than specified product.

SECTION 10**OTHER INFORMATION**

Chromium compounds are classed as known human carcinogens by IARC and NTP.

Tests on laboratory animals indicate material may produce adverse mutagenic and reproductive effects.

EMERGENCY PHONE NUMBER (608) 354-9200

DATE ISSUED: 7/84

DATE REVISED: 9/27/86



EM SCIENCE

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MATERIAL SAFETY DATA SHEET

Essentially Similar to U.S. Department of Labor Form OSHA-20

SECTION 1		NAME & PRODUCT	
Chemical Name:	Hydrochloric Acid (various dilutions)	0.01 N 9974 0.02 N 64348 0.1 N 326, 1248A, 9973, 15081 0.2 NX06048 0.4 64349	Catalog Number: NX0604A, See Section 9 for add'l item numbers
Trade Name & Synonyms:	Hydrogen Chloride in aqueous solution	Chemical Family: Inorganic Acid	
Formula:	HC1	Formula Weight:	36.46
SECTION 2		PHYSICAL DATA	
Boiling Point, 760 mm Hg (°C)	varies with	Specific Gravity (H ₂ O = 1)	varies
Melting Point (°C)	concentration	Solubility in H ₂ O, % by wt. at 20°C	Miscible
Vapor Pressure at 20°C	see	Appearance and Odor	clear liquid
Vapor Density (air = 1)	chemical		irritating, pungent odor
Percent Volatiles by Volume	handbook	Evaporation Rate (Butyl Acetate = 1)	N/A
SECTION 3		FIRE AND EXPLOSION HAZARD DATA	
Flash Point (test method)	Nonflammable	Flammable Limits	Le1 N/A Uel N/A
Extinguishing Media	Water spray		
Special Hazards and Procedures	Wear self-contained breathing apparatus Wear full protective clothing		
Unusual Fire and Explosion Hazards	Contact with metals may produce hydrogen which forms explosive mixtures with air		
SECTION 4		REACTIVITY DATA	
Stable	X	Conditions to Avoid	
Unstable		None	
Materials to Avoid			
() Water () Acids (X) Bases () Corrosives () Oxidizers			
(X) Other (specify) Metals, metal oxides, amines, carbonates, alkalies			
Hazardous Decomposition Products		toxic hydrogen chloride gas	
SECTION 5		SPEL OR LEAK PROCEDURES AND DISPOSAL	
Steps to be Taken in Case Material is Released or Spilled		Neutralize with soda ash/slaked lime mixture Flush area with water	
Waste Disposal Method		To be performed in compliance with all current local, state, and federal regulations	

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Hydrochloric Acid (various dilutions)

SECTION 6

HEALTH HAZARD DATA

Threshold Limit Value

5 ppm (as HCl)

TKDS: inh-hmn LCLo: 1000 ppm/LM

Effects of Overexposure

Highly corrosive by liquid or fume contact
Causes burns; harmful if swallowed
Inhalation may cause severe pulmonary edema

First Aid Procedures

GET IMMEDIATE MEDICAL ATTENTION FOR ALL CASES OF OVEREXPOSURE

Skin: flush with large amounts of water

Eyes: flush thoroughly with water 15 minutes holding lids apart

Inhalation: remove to fresh air

Ingestion: do not induce vomiting; drink milk or water if conscious

SECTION 7

SPECIAL PROTECTION INFORMATION

Ventilation, Respiratory Protection, Protective Clothing, Eye Protection

Provide adequate general mechanical and local exhaust ventilation

Protect eyes and skin with safety goggles and gloves

Wear face shield and impervious clothing

Do not breathe vapor

Do not get in eyes, on skin, or on clothing

SECTION 8

SPECIAL HANDLING AND STORING PRECAUTIONS

Keep container closed and protected against physical damage

Store in a cool, well-ventilated area separated from incompatible materials

Store separate from oxidizers

Wear vapor-proof goggles

Wash thoroughly after handling

Handle empty containers with caution

SECTION 9

HAZARDOUS INGREDIENTS

(refer to section 3 through 8)

0.5 N 1248C, 9971, HX0604C

1 N 1248D, 3864, 9970, HX0604D

5 N 9911

6 N 1253

10 N 12535

SECTION 10

OTHER INFORMATION

DOT - Corrosive Liquid

MFPA 704: 3

0

0

Health Flammability Reactivity

EMERGENCY PHONE NUMBER (808) 423-8300

AUTHORIZED SIGNATURE



DATE ISSUED: 12/81

DATE REVISED: 3/84

EM00147A



UPDATED

111 Woodcrest Road, Cherry Hill, New Jersey 08034-0395, Phone (609) 354-9200

MATERIAL SAFETY DATA SHEET

Essentially Similar to U.S. Department of Labor Form OSHA-20

SECTION 1		NAME & PRODUCT	
Chemical Name: Hydrochloric Acid		Catalog Number: 314, 315, 317, 321, FX603	
Trade Name & Synonyms: Muriatic Acid, 23° Be		Chemical Family: Acid	
Formula: HCl (approx. 37% in water)		Formula Weight: 36.46	
SECTION 2		PHYSICAL DATA	
Boiling Point, 760 mm Hg 110°C (20.24% constant boiling mixture)		Specific Gravity (H ₂ O = 1) 20°/20°C 1.1885	
Melting Point (°C)		Solubility in H ₂ O, % by wt. at 20°C Miscible	
Vapor Pressure at 20°C approx. 160 mm Hg		Appearance and Odor clear, colorless	
Vapor Density (air = 1) 1.25		liquid: acrid odor	
Percent Volatiles by Volume 37		Evaporation Rate (Butyl Acetate = 1) 10	
SECTION 3		FIRE AND EXPLOSION HAZARD DATA	
Flash Point (test method) Nonflammable		Flammable Limits LeI N/A Uel N/A	
Extinguishing Media Water spray			
Special Hazards and Procedures Wear self-contained breathing apparatus Wear full protective clothing			
Unusual Fire and Explosion Hazards Contact with metals produces hydrogen which may form explosive mixtures with air			
SECTION 4		REACTIVITY DATA	
Stable X		Conditions to Avoid None	
Unstable			
Materials to Avoid () Water () Acids (X) Bases () Corrosives () Oxidizers (X) Other (specify) Alkalies and amines; contact with metals produces hydrogen			
Hazardous Decomposition Products toxic hydrogen chloride gas			
SECTION 5		SPILL OR LEAK PROCEDURES AND DISPOSAL	
Steps to be Taken in Case Material is Released or Spilled Neutralize with soda ash/slaked lime mixture Flush area with water			
Waste Disposal Method To be performed in compliance with all current local, state and federal regulations			

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314, 315, 317, 321, HX0603

SECTION 6

HEALTH HAZARD DATA

Threshold Limit Value

5 ppm

TXDS: ihl-hmn LDLo: 1000 ppm/1M
orl-rbt LD50: 900 mg/kg

Effects of Overexposure

Causes severe irritation of respiratory passages, dermatitis, severe and rapid eye damage, chest pain, choking cough. May cause severe burns, pulmonary edema, circulatory collapse and death.

First Aid Procedures

GET IMMEDIATE MEDICAL ATTENTION FOR ALL CASES OF OVEREXPOSURE

Skin: flush with large amounts of water

Eyes: flush with water 15 minutes holding lids open

Inhalation: remove to fresh air

Ingestion: do not induce vomiting; give water or milk if conscious

SECTION 7

SPECIAL PROTECTION INFORMATION

Ventilation, Respiratory Protection, Protective Clothing, Eye Protection

Provide adequate general mechanical and local exhaust ventilation

Protect eyes and skin with safety goggles and gloves

Wear face shield and impervious clothing including apron and long sleeves

Do not breathe vapor

Do not get in eyes, on skin, or on clothing

SECTION 8

SPECIAL HANDLING AND STORING PRECAUTIONS

Keep container closed and protected against physical damage

Store in a cool, well-ventilated area separated from incompatible materials

Store separate from oxidizers

Wear vapor-proof goggles

Wash thoroughly after handling

Handle empty containers with caution

SECTION 9

HAZARDOUS INGREDIENTS

(refer to section 3 through 8)

DOT - Corrosive Liquid

SECTION 10

OTHER INFORMATION

NEPA 704: 3 0 0
 Health Flammability Reactivity

AUTHORIZED SIGNATURE

Bruce C. [Signature]

DATE ISSUED: 3/84
DATE REVISED: 11/84

5120147A



EM SCIENCE

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MATERIAL SAFETY DATA SHEET

(Approved by U.S. Department of Labor "Essentially Similar to Form OSHA-20")

SECTION 1 NAME & PRODUCT			
Chemical Name: Sodium Hydroxide Solution 0.02N		Catalog Number: SX0606A	
Trade Name & Synonyms: Soda Lye		Chemical Family: Base	
CA #1310-73-2			
Formula: NaOH in H ₂ O		Formula Weight: 58.01 (NaOH)	
SECTION 2 PHYSICAL DATA			
Boiling Point, 760 mm Hg (°C)		Specific Gravity (H ₂ O = 1)	
Melting Point (°C)		Solubility in H ₂ O, % by wt. at 20°C	solutio
Vapor Pressure at 20°C		Appearance and Odor	Clear solution
Vapor Density (air = 1)			
Percent Volatiles by Volume		Evaporation Rate (Butyl Acetate = 1)	
SECTION 3 FIRE AND EXPLOSION HAZARD DATA			
Flash Point (test method)	Not combustible	Flammable Limits	Lel _____ Uel _____
Extinguishing Media	N/A		
Special Hazards and Procedures	N/A		
Unusual Fire and Explosion Hazards	N/A		
SECTION 4 REACTIVITY DATA			
Stable	<input checked="" type="checkbox"/>		
Unstable			
Conditions to Avoid			
Materials to Avoid			
() Water	(X) Acids	() Bases	() Corrosives () Oxidizers
(X) Other (specify) Metals, organic halogens, nitro compounds, Al, Sn, Zn			
Hazardous Decomposition Products			
SECTION 5 SPILL OR LEAK PROCEDURES AND DISPOSAL			
Steps to be Taken in Case Material is Released or Spilled		Neutralize with 6M HCl, dilute with large volume of water.	
Waste Disposal Method		To be performed in compliance with all current local, state and federal regulations.	

We believe the data contained herein is factual, however, it is offered solely for your consideration, investigation, and verification. Do not take as a warranty.

SECTION 3 HEALTH HAZARD DATA	
Threshold Limit Value	2mg/m ³ /15m ceil (NIOSH)
Effects of Overexposure	Can irritate or burn eyes, skin, and nose. Cause pneumonitis and temporary loss of hair.
First Aid Procedures	<p>Skin: wash with soap/water, get medical assistance.</p> <p>Eyes: wash with water, get medical assistance.</p> <p>Inhalation: remove to fresh air, get medical assistance.</p> <p>Ingestion: get medical attention.</p>
SECTION 4 SPECIAL PROTECTION INFORMATION	
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection	<p>Provide adequate general and exhaust ventilation.</p> <p>Protect eyes and skin with safety goggles and gloves.</p>
SECTION 5 SPECIAL HANDLING AND STORING PRECAUTIONS	
Store in cool area away from acids and other incompatible material. (section 4)	DOT-Corrosive Liquid
SECTION 6 HAZARDOUS INGREDIENTS	
(refer to section 3 through 5)	
SECTION 7 OTHER INFORMATION	

Non-responsive PHONE NUMBER (513) 631-0445

AUTHORIZED SIGNATURE

Bruce C. ...

DATE ISSUED:

3/82

DATE REVISED:



EM SCIENCE

111 Woodcrest Road, P.O. Box 5018, Cherry Hill, N.J. 08034-0396, Phone (800) 354-8200

MATERIAL SAFETY DATA SHEET

(Approved by U.S. Department of Labor "Essentially Similar to Form OSHA-20")

SECTION 1 NAME & PRODUCT			
Chemical Name:		Catalog Number:	
Sodium Hydroxide Solution 0.05N		SX0606B	
Trade Name & Synonyms:		Chemical Family:	
Soda Lye		Base	
CA #1310-73-2			
Formula:		Formula Weight:	
NaOH in H ₂ O		58.01 (NaOH)	
SECTION 2 PHYSICAL DATA			
Boiling Point, 760 mm Hg (°C)		Specific Gravity (H ₂ O = 1)	
Melting Point (°C)		Solubility in H ₂ O, % by wt. at 20°C	solution
Vapor Pressure at 20°C		Appearance and Odor	Clear solution
Vapor Density (air = 1)			
Percent Volatiles by Volume		Evaporation Rate (Butyl Acetate = 1)	
SECTION 3 FIRE AND EXPLOSION HAZARD DATA			
Flash Point (test method)	Not Combustible	Flammable Limits	Lel _____ Uel _____
Extinguishing Media N/A			
Special Hazards and Procedures N/A			
Unusual Fire and Explosion Hazards N/A			
SECTION 4 REACTIVITY DATA			
Stable <input checked="" type="checkbox"/>	Conditions to Avoid		
Unstable			
Materials to Avoid			
() Water (X) Acids () Bases () Corrosives () Oxidizers			
(X) Other (specify) Metals, organic halogens, nitro compounds, Al, Sn, Zn			
Hazardous Decomposition Products _____			
SECTION 5 SPILL OR LEAK PROCEDURES AND DISPOSAL			
Steps to be Taken in Case Material is Released or Spilled		Neutralize with 6M HCl dilute with large volume of water	
Waste Disposal Method		to be performed in compliance with all current local, state and federal regulations.	

We believe the data contained herein is factual, however, it is offered solely for your consideration, investigation, and verification.
Do not take as a warranty.

SECTION 3 HEALTH HAZARD DATA

Threshold Limit Value $2\text{mg}/\text{m}^3/15\text{m}$ cell (NIOSH)

Effects of Overexposure

Can irritate or burn eyes, skin and nose. Cause pneumonitis and temporary loss of hair.

First Aid Procedures

Skin: wash with soap/water, get medical assistance.
Eyes: wash with water, get medical assistance.
Inhalation: remove to fresh air, get medical assistance.
Ingestion: get medical attention.

SECTION 4 SPECIAL PROTECTION INFORMATION

Ventilation, Respiratory Protection, Protective Clothing, Eye Protection

Provide adequate general and exhaust ventilation.
Protect eyes and skin with safety goggles and gloves.

SECTION 5 SPECIAL HANDLING AND STORING PRECAUTIONS

Store in cool area away from acids and other incompatible material.
(section 4)

DOT-Corrosive Liquid

SECTION 6 HAZARDOUS INGREDIENTS

(refer to section 3 through 8)

SECTION 10 OTHER INFORMATION

EMERGENCY PHONE NUMBER (513) 631-0445

AUTHORIZED SIGNATURE

Bruce Rame

DATE ISSUED: 3/82

DATE REVISED: _____

MC/8 1001



EM SCIENCE

111 Woodcrest Road, P.O. Box 5018, Cherry Hill, N.J. 08034-0395, Phone (609) 354-9200

MATERIAL SAFETY DATA SHEET

(Approved by U.S. Department of Labor "Essentially Similar to Form OSHA-20")

SECTION 1		NAME & PRODUCT	
Chemical Name:	Sodium Hydroxide Solution 0.1N		Catalog Number: SX0606C
Trade Name & Synonyms:	Soda Lye CA #1310-73-2		Chemical Family: Base
Formula:	NaOH in H ₂ O		Formula Weight: 58.01 (NaOH)
SECTION 2		PHYSICAL DATA	
Boiling Point, 760 mm Hg (°C)		Specific Gravity (H ₂ O = 1)	
Melting Point (°C)		Solubility in H ₂ O, % by wt. at 20°C	solution
Vapor Pressure at 20°C		Appearance and Odor	Clear solution
Vapor Density (air = 1)			
Percent Volatiles by Volume		Evaporation Rate (Butyl Acetate = 1)	
SECTION 3		FIRE AND EXPLOSION HAZARD DATA	
Flash Point (test method)	Not Combustible	Flammable Limits	LeI UeI
Extinguishing Media	N/A		
Special Hazards and Procedures	N/A		
Unusual Fire and Explosion Hazards	N/A		
SECTION 4		REACTIVITY DATA	
Stable	X	Conditions to Avoid	
Unstable			
Materials to Avoid			
() Water (X) Acids () Bases () Corrosives () Oxidizers			
(X) Other (specify) Metals, organic halogens, nitro compounds, Al, Sn, Zn			
Hazardous Decomposition Products			
SECTION 5		SPILL OR LEAK PROCEDURES AND DISPOSAL	
Steps to be Taken in Case Material is Released or Spilled		Neutralize with 6M HCl, dilute with large volume of water.	
Waste Disposal Method		To be performed in compliance with all current local, state and federal regulations.	

We believe the data contained herein is factual, however, it is offered solely for your consideration, investigation, and verification. Do not take as a warranty.

SECTION 2 - HEALTH HAZARD DATA	
Threshold Limit Value	2mg/m ³ /15m cell (NIOSH)
Effects of Overexposure	
Can irritate or burn eyes, skin and nose. Cause pneumonitis and temporary loss of hair.	
First Aid Procedures	
Skin: wash with soap/water, get medical assistance. Eyes: wash with water, get medical assistance. Inhalation: remove to fresh air, get medical assistance. Ingestion: get medical attention.	
SECTION 3 - SPECIAL PRECAUTIONS (AND INFORMATION)	
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection	
Provide adequate general and exhaust ventilation. Protect eyes and skin with safety goggles and gloves.	
SECTION 4 - SPECIAL HANDLING AND STORING PRECAUTIONS	
Store in cool area away from acids and other incompatible material. (section 4)	
DOT-Corrosive Liquid	
SECTION 5 - HAZARDOUS INGREDIENTS	
(refer to section 3 through 8)	
SECTION 6 - OTHER INFORMATION	

EMERGENCY PHONE NUMBER (513) 631-0445

AUTHORIZED SIGNATURE

Bruce Carter

DATE ISSUED:

3/82

DATE REVISED:

MC 1101



EM SCIENCE

111 Woodcrest Road, P.O. Box 5018, Cherry Hill, N.J. 08034-0395, Phone (609) 354-9200

MATERIAL SAFETY DATA SHEET

Essentially Similar to U.S. Department of Labor Form OSHA-20

SECTION 1		NAME & PRODUCT					
Chemical Name:	Sodium Hydroxide Solution, 10%	Catalog Number:	2262	Catalog Number:	1 Normal	SX0606H	1306D
Trade Name & Synonyms:	Soda Lye	CAS #1310-73-2	Chemical Family:	Base			
Formula:	NaOH in H ₂ O	Formula Weight:	58.01 (NaOH)				
SECTION 2		PHYSICAL DATA					
Boiling Point, 760 mm Hg (°C)	N/A	Specific Gravity (H ₂ O = 1)	N/A				
Melting Point (°C)	N/A	Solubility in H ₂ O, % by wt. at 20°C	Solution				
Vapor Pressure at 20°C	N/A	Appearance and Odor	clear, colorless				
Vapor Density (air = 1)	N/A		liquid				
Percent Volatiles by Volume	N/A	Evaporation Rate (Butyl Acetate = 1)	N/A				
SECTION 3		FIRE AND EXPLOSION HAZARD DATA					
Flash Point (test method)	Nonflammable	Flammable Limits	LeI	N/A	UeI	N/A	
Extinguishing Media	N/A						
Special Hazards and Procedures	Wear self-contained breathing apparatus and face shield						
Unusual Fire and Explosion Hazards	None						
SECTION 4		REACTIVITY DATA					
Stable	X	Conditions to Avoid					
Unstable		None					
Materials to Avoid							
() Water	(X) Acids	() Bases	() Corrosives	() Oxidizers			
(X) Other (specify) Metals, Organic halogens, Nitro compounds, Al, Sn, Zn							
Hazardous Decomposition Products	N/A						
SECTION 5		SPILL OR LEAK PROCEDURES AND DISPOSAL					
Steps to be Taken in Case Material is Released or Spilled	Neutralize with 6M HCl, dilute with large volume of water						
Waste Disposal Method	To be performed in compliance with all current local, state and federal regulations						

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SK0606B, 1306D, 2262

SECTION 6

HEALTH HAZARD DATA

Threshold Limit Value

2 mg/m³/15M ceiling (NIOSH)

Effects of Overexposure

Irritation to burns of eyes, skin, nose
May cause pneumonitis and temporary loss of hair

First Aid Procedures

Skin: flush with copious amounts of water; get medical assistance
Eyes: flush thoroughly with water 15 minutes; get medical assistance
Inhalation: remove to fresh air; get medical assistance
Ingestion: get medical assistance

SECTION 7

SPECIAL PROTECTION INFORMATION

Ventilation, Respiratory Protection, Protective Clothing, Eye Protection

Provide adequate general mechanical and local exhaust ventilation
Protect eyes and skin with safety goggles, face shield and resistant gloves
Do not breathe vapor
Do not get in eyes, on skin, or on clothing

SECTION 8

SPECIAL HANDLING AND STORING PRECAUTIONS

Keep container closed
Store in a cool area away from acids and other incompatible material
Wash thoroughly after handling

DOT - Corrosive Liquid

SECTION 9

HAZARDOUS INGREDIENTS

(refer to section 3 through 8)

N/A

SECTION 10

OTHER INFORMATION

N/A

EMERGENCY PHONE NUMBER (800) 423-8300

AUTHORIZED SIGNATURE

Bruce Green

DATE ISSUED: 3/82

DATE REVISED: 3/84

EM00147A



EM SCIENCE

111 Woodcrest Road, P.O. Box 5018, Cherry Hill, N.J. 08034-0395, Phone (609) 354-9200

MATERIAL SAFETY DATA SHEET

(Approved by U.S. Department of Labor "Essentially Similar to Form OSHA-20")

SECTION 1 NAME & PRODUCT			
Chemical Name: Sodium Hydroxide Solution 5N		Catalog Number: SXD606L	
Trade Name & Synonyms: Soda Lye		Chemical Family: Base	
Formula: NaOH in H₂O		Formula Weight: 58.01 (NaOH)	
SECTION 2 PHYSICAL DATA			
Boiling Point, 760 mm Hg (°C)		Specific Gravity (H ₂ O = 1)	
Melting Point (°C)		Solubility in H ₂ O, % by wt. at 20°C	Solution
Vapor Pressure at 20°C		Appearance and Odor	Clear solution
Vapor Density (air = 1)			
Percent Volatiles by Volume		Evaporation Rate (Butyl Acetate = 1)	
SECTION 3 FIRE AND EXPLOSION HAZARD DATA			
Flash Point (test method)	Not Combustible	Flammable Limits	Le: — Uel: —
Extinguishing Media N/A			
Special Hazards and Procedures N/A			
Unusual Fire and Explosion Hazards N/A			
SECTION 4 REACTIVITY DATA			
Stable X	Conditions to Avoid		
Unstable			
Materials to Avoid () Water (X) Acids () Bases () Corrosives () Oxidizers (X) Other (specify) Metals, organic halogens, nitro compounds, Al, Sn, Zn			
Hazardous Decomposition Products —			
SECTION 5 SPILL OR LEAK PROCEDURES AND DISPOSAL			
Steps to be Taken in Case Material is Released or Spilled		Neutralize with 6M HCl, dilute with large volume of water.	
Waste Disposal Method To be performed in compliance with all current local, state and federal regulations.			

We believe the data contained herein is factual, however, it is offered solely for your consideration, investigation, and verification.
Do not take as a warranty.

SECTION 1 - HEALTH HAZARD DATA	
Threshold Limit Value	2mg/m ³ /15m cell (NIOSH)
Effects of Overexposure Can irritate or burn eyes, skin and nose. Cause pneumonitis and temporary loss of hair.	
First Aid Procedures Skin: wash with soap/water, get medical assistance. Eyes: wash with water, get medical assistance. Inhalation: remove to fresh air, get medical assistance. Ingestion: get medical attention.	
SECTION 2 - SPECIAL PROTECTION INFORMATION	
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection Provide adequate general and exhaust ventilation. Protect eyes and skin with safety goggles and gloves.	
SECTION 3 - SPECIAL HANDLING AND STORING PRECAUTIONS	
Store in cool area away from acids and other incompatible material (section 4) DOT-Corrosive Liquid	
SECTION 4 - HAZARDOUS INGREDIENTS	
(refer to section 3 through 8)	
SECTION 5 - OTHER INFORMATION	

EMERGENCY PHONE NUMBER (513) 631-0445

AUTHORIZED SIGNATURE

Bruce Rane

DATE ISSUED:

3/82

DATE REVISED:

MCB 1101



111 Woodcrest Road, Cherry Hill, New Jersey 08034-0306, Phone (609) 354-9200

REVISED

MATERIAL SAFETY DATA SHEET

Essentially Similar to U.S. Department of Labor Form OSHA-20

SECTION 1		NAME & PRODUCT	
Chemical Name: Nitric Acid		Catalog Number: NX0409, NX0409I, NX0411, NX0412, #441	
Trade Name & Synonyms: Aqua Fortis; Hydrogen Nitrate		Chemical Family: Inorganic Acid	
Formula: HNO_3 (approx. 70% in H_2O)		CAS #7697-37-2	Formula Weight: 63.01
SECTION 2		PHYSICAL DATA	
Boiling Point, 760 mm Hg (°C)	122°	Specific Gravity ($\text{H}_2\text{O} = 1$)	1.41
Melting Point (°C)	-34°	Solubility in H_2O , % by wt. at 20°C	Miscible
Vapor Pressure at 20°C	62 mm Hg	Appearance and Odor Colorless liquid with	
Vapor Density (air = 1)	approx. 2.5	acid odor	
Percent Volatiles by Volume	indeterminate	Evaporation Rate (Butyl Acetate = 1)	Unavailab
SECTION 3		FIRE AND EXPLOSION HAZARD DATA	
Flash Point (test method)	Noncombustible	Flammable Limits	Lei N/A Uel N/A
Extinguishing Media Water spray, dry chemical			
Special Hazards and Procedures Wear self-contained breathing apparatus and protective clothing.			
Unusual Fire and Explosion Hazards		Can react explosively with certain reducing agents and combustibl such as, metal powders, carbides, H_2S , turpentine.	
SECTION 4		REACTIVITY DATA	
Stable X	Conditions to Avoid		
Unstable	Strong oxidizer! Avoid contact with all combustible matter.		
Materials to Avoid			
(X) Steam	() Acids	(X) Bases	() Corrosives () Oxidizers
(X) Other (specify) Reducing agents, organic materials, combustible matter			
Hazardous Decomposition Products		NO_x	
SECTION 5		SPILL OR LEAK PROCEDURES AND DISPOSAL	
Steps to be Taken in Case Material is Released or Spilled		Dike spill with sand & soda ash, dilute with wat and take up for proper disposal.	
Waste Disposal Method		To be performed in compliance with all current local, state, and federal regulations	

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NX0409, NX0409I, NX0411,
NX0412, #441



NFPA

SECTION 6 HEALTH HAZARD DATA

Threshold Limit Value / PEL: 2 ppm (TWA)

TXDS: unr-man LDLo: 110 mg/kg
(RTECS, 1986)

Effects of Overexposure

Causes severe burns on contact with any body tissue. Inhalation of vapors or mists can cause severe burns to respiratory passages, pneumonia and pulmonary edema. Can be fatal if inhaled or swallowed. Symptoms of lung injury may be delayed.

First Aid Procedures GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.

Skin: Immediately flush thoroughly with large amounts of water - remove contaminated clothing at once.

Eyes: Immediately flush thoroughly with water for at least 15 minutes.

Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.

Ingestion: Do not induce vomiting; if conscious, give water freely and get medical attention.

SECTION 7

SPECIAL PROTECTION INFORMATION

Ventilation, Respiratory Protection, Protective Clothing, Eye Protection

Material must be handled or transferred in an approved fume hood or with equivalent ventilation. Protective gloves (Natural Rubber, Neoprene, PVC, or equivalent) must be worn to prevent skin contact.

Protective clothing (Natural Rubber, Neoprene, PVC, or equivalent) should be worn when handling this material.

Safety glasses with side shields must be worn at all times.

NIOSH-approved respirator should be worn in the absence of adequate ventilation.

SECTION 8

SPECIAL HANDLING AND STORING PRECAUTIONS

Keep container tightly closed. Store in a cool, dry area away from combustible or reducing materials. Do not breathe vapor or mist. Do not get in eyes, on skin, or on clothing. Do not take internally. Empty containers may be hazardous due to retained residue; use caution! Protect from physical damage.

SECTION 9

HAZARDOUS INGREDIENTS

(refer to section 3 through 8)

None other than specified product.

SECTION 10

OTHER INFORMATION

Tests on laboratory animals indicate material may produce adverse reproductive effects.

EMERGENCY PHONE NUMBER (609) 354-9200

DATE ISSUED: 8/81

DATE REVISED: 11/83; 1/24/87

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111 Woodcrest Road, Cherry Hill, New Jersey 08034-0395, Phone (609) 354-8200

REVISED

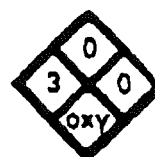
MATERIAL SAFETY DATA SHEET

Essentially Similar to U.S. Department of Labor Form OSHA-20

SECTION 1		NAME & PRODUCT	
Chemical Name:	Nitric Acid, 90%		Catalog Number: NX0404
Trade Name & Synonyms:		Chemical Family:	
Aqua Fortis; Hydrogen Nitrate		Inorganic Acid	
Formula:	CAS #7697-37-2	Formula Weight:	
HNO_3 (90% min. in H_2O)		63.01	
SECTION 2		PHYSICAL DATA	
Bolling Point, 760 mm Hg (°C)	approx. 83°	Specific Gravity ($\text{H}_2\text{O} = 1$)	1.49
Melting Point (°C)	-50°	Solubility in H_2O , % by wt. at 20°C	Miscible
Vapor Pressure at 20°C	Unavailable	Appearance and Odor Colorless to reddish-	
Vapor Density (air = 1)	approx. 2.5	yellow liquid - acrid odor	
Percent Volatiles by Volume	Indeterminate	Evaporation Rate (Butyl Acetate = 1)	Unavailab
SECTION 3		FIRE AND EXPLOSION HAZARD DATA	
Flash Point (test method) Noncombustible	Flammable Limits	Lei N/A	Uei N/A
Extinguishing Media Water spray, dry chemical			
Special Hazards and Procedures Wear self-contained breathing apparatus and protective clothing.			
Unusual Fire and Explosion Hazards		Can react explosively with certain reducing agents and combustibles, such as; metal powders, carbides, H_2S , turpentine.	
SECTION 4		REACTIVITY DATA	
Stable X	Conditions to Avoid		
Unstable	Powerful oxidizer! Avoid contact with all combustible matter.		
Materials to Avoid			
(X) Steam () Acids (X) Bases () Corrosives () Oxidizers			
(X) Other (specify) Reducing agents, organic materials, combustible matter			
Hazardous Decomposition Products		NO_x	
SECTION 5		SPILL OR LEAK PROCEDURES AND DISPOSAL	
Steps to be Taken in Case Material is Released or Spilled		Dike spill with sand and soda ash, dilute with water and take up for proper disposal.	
Waste Disposal Method		To be performed in compliance with all current local, state, and federal regulations	

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NX0404



NFPA

SECTION 6 HEALTH HAZARD DATA

Threshold Limit Value / PEL: 2 ppm (TWA)

TXDS: inh-rat LC50: 67 ppm (NO₂)/4H

Effects of Overexposure

Causes severe burns on contact with any body tissue. Inhalation of vapors or mists can cause severe burns to respiratory passages, pneumonia and pulmonary edema. Can be fatal if inhaled or swallowed. Symptoms of lung injury may be delayed.

First Aid Procedures GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.

Skin: Immediately flush thoroughly with large amounts of water - remove contaminated clothing at once.

Eyes: Immediately flush thoroughly with water for at least 15 minutes.

Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.

Ingestion: Do not induce vomiting; if conscious, give water freely and get medical attention.

SECTION 7

SPECIAL PROTECTION INFORMATION

Ventilation, Respiratory Protection, Protective Clothing, Eye Protection

Material must be handled or transferred in an approved fume hood or with equivalent ventilation. Protective gloves (Natural Rubber, Neoprene, PVC, or equivalent) must be worn to prevent skin contact.

Protective clothing (Natural Rubber, Neoprene, PVC, or equivalent) should be worn when handling this material.

Safety glasses with side shields must be worn at all times.

NIOSH-approved respirator should be worn in the absence of adequate ventilation.

SECTION 8

SPECIAL HANDLING AND STORING PRECAUTIONS

Keep container tightly closed. Store in a cool, dry area away from combustible or reducing materials. Do not breathe vapor or mist. Do not get in eyes, on skin, or on clothing. Do not take internally. Empty containers may be hazardous due to retained residue - use caution! Protect from physical damage.

SECTION 9

HAZARDOUS INGREDIENTS

(refer to section 3 through 8)

None other than specified product.

SECTION 10

OTHER INFORMATION

Tests on laboratory animals indicate material may produce adverse reproductive effects.

EMERGENCY PHONE NUMBER (609) 354-9200

DATE ISSUED: 1/82

DATE REVISED: 8/83; 1/24/87

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APPENDIX 7-D

RESPIRATORY PROTECTION PROGRAM

2.2 RESPIRATORY PROTECTION PROGRAM

2.2 RESPIRATORY PROTECTION PROGRAM

Where at all possible, engineering controls and administrative practices will be used to prevent employee exposure to airborne contaminants. Where engineering controls are not feasible or respiratory protection is required in addition to engineering controls, a respiratory protection program is established on a project-by-project or program-by-program basis.

2.2.1 Respiratory Protection

Specific types of respirators and appropriate filtering media or air supplies will be assigned to each task within a project or program. Action levels or standard operating practices will be established for each task requiring the use of a respirator. The action level or operating practice will establish when respirators are required and under what circumstances change in respiratory protection may be made. A qualified person will be assigned to each program, project, or site who will be responsible for implementing the respiratory protection program including monitoring or sampling and determining when respiratory protection use is appropriate and when changes are to be made.

Respiratory selection, use, maintenance, storage and qualification will be in conformance with OSHA 29 CFR 1910.134, Respiratory Protection, and ANSI Z88.2, Practices for Respiratory Protection.

This base document and the Health and Safety Plan for each project or program serves as the written respiratory protection program. Any change in this program must be authorized by WESTON Corporate Health and Safety.

2.2.1.1 Hazards

Preparation of a program, project, or site Health and Safety Plan entails the identification of chemical, biological, radiological, and physical hazards to which workers may be exposed, including the assessment of the risk of exposure to airborne inhalation hazards.

Unknown air quality and known or suspected conditions of oxygen deficiency, toxic levels of airborne contaminants, Immediately Hazardous to Life or Health Levels of airborne chemicals and noxious atmospheres represent conditions, where, if engineering or administrative controls are not feasible or do not provide adequate protection, use of respiratory protection is required.

2.2.1.2 Selection

When respirators are required for personal protection, they are selected on the basis of hazards identified, risk of exposure and the following criteria:

1. Respirators purchased by WESTON must be approved by Corporate Health & Safety prior to purchase.
2. Respirators must be MSHA/NIOSH certified according to 30 CFR 11.
3. Respirators must be selected and approved for protection against the hazard, the concentration, and the degree of risk of exposure to the hazard.
4. Respirators must have full facepieces unless a specific exception is granted by Corporate Health & Safety.
5. Respirators worn by subcontractors must be or accepted respirators that provide adequate protection for the contaminants of concern. The determination of approval or adequacy is related to the risk assessment information from the project or program Health and Safety Plan.
6. Air purifying respirators (APR's) may not be selected for use in situations where:
 - a. Known or potential O₂ deficiency (<19.5%) conditions exist.
 - b. The identity/concentration of the contaminant(s) is unknown.
 - c. Level of any contaminant exceeds either the IDLH value or the Maximum Use Concentration value.
 - d. A cartridge or canister certified for protection of the contaminant does not exist.
 - e. A contaminant does not have adequate warning properties.
 - f. A wearer has or can not be properly fitted or medically certified.
7. Air supplying respirators certified for use in IDLH or O₂ deficient atmospheres must be selected if conditions of 6a through 6f cannot be met.
8. Any compressed air used for air supplying respiratory protection must be certified as Grade "D" or equivalent, whether purchased in cylinders or tanks or compressors are used.
9. The CHSD must pre-approve the use of compressors for air supplying respirators.

Only breathing air-type compressors with compressor failure, overheating alarms, and sufficient capacity receivers to allow escape from a contaminated atmosphere may be used.

10. All compressed air cylinders must be tested in accordance with U.S. Department of Transportation (49 CFR Part 178) and labelled to identify their contents in accordance with ANSI Standard Z48.1, Federal Specification BB-A-103a, or Interim Federal Specification GG-B-00675b.
11. Airline couplings must be incompatible with other gas systems to prevent accidental introduction of non-respirable gases.
12. An Escape Breathing Apparatus (EBA) must be selected for permanent location in or be required to be carried in certain circumstances where normal conditions do not require use of air supplying respirators, but spills, releases, or other accidental occurrences would require their use for escape.
13. EBAs must not be selected as the primary provider of respiratory protection when knowingly entering an IDLH or O₂ deficient atmosphere.
14. EBAs must not be selected where time of travel to a safe area is more than the minimum rated time duration of the EBA.
15. The CHSD must pre-approve the selection of closed circuit SCBAs and airline respirators without EBAs.

2.2.1.3 Use

Use of respiratory protection is contingent upon the following conditions and criteria being met:

1. No person may use a respirator on a WESTON project or program requiring respiratory protection unless they can provide proof of:
 - a. Having been trained in the use of the respirators.
 - b. Having been certified to wear the respirator by a physician.
 - c. Having been fit tested with the type, style, and brand of respirator to be used, if the respirator is a negative pressure respirator.
2. Respirators must be used according to manufacturer's instructions, regulatory requirements, selection criteria listed above, and HASP provisions.
3. A respirator may not be used if any item of clothing, other PPE, hair or facial hair may interfere with the function or fit of the respirator.

4. A respirator may not be used unless appropriate air sampling or monitoring is performed to ascertain that the respirator is being used within established limits.
5. Parts or attachments for one respirator type or brand may not be substituted with another type or brand unless specifically approved by the manufacturers.
6. Respirators must be worn at all times in designated areas and may be removed only during prescribed decontamination procedures or in conformance with a pre-determined contingency plan.
7. Respirator use areas must be defined, ideally by appropriate signs, barrier markers or solid barriers, but, as a minimum by clear delineation in each HASP.
8. Wherever possible, respirators will be assigned to individuals for their exclusive use on a project.
9. The "buddy system" will be used on all WESTON controlled hazardous materials sites, requiring at least two (2) medically qualified and trained persons on any Level D or C sites, a minimum of three (3) qualified persons on Level B sites, and a minimum of five (5) persons on Level A sites.
10. A "safety watch" system will be used on all projects where supplied air respirators are used as the primary protection or sites where carrying of escape masks are required. A safety watch must be able to monitor site activities by line of site, tie line, or electronic communication from a safe location, must have rescue gear including PPE capabilities equal to that of the entry team, immediately available, and may have no other distracting duties.
11. Breathing air cylinders must be secured against falling and protected from damage from vehicles or effects of weather.
12. Air supplying respirators certified for entry to IDLH and O₂ deficient atmospheres must be immediately available, in a safe location outside any area where EBAs are required.
13. Air hoses of airline respirators must be monitored by the safety watch and be used in such a way as to prevent their:
 - a. Lying in direct contact with contaminants.
 - b. Snagging on unstable objects.
 - c. Crossing travel ways or work areas where they may be run over.

- d. Crossing sharp edges or through doorways where sharp edges or a door closing will cut the hose.
- 14. Steps must be taken to minimize contact of respirator parts with contaminants. Where risk of contact is high, additional PPE such as face shields, aprons, and wrapping for air hoses must be used.
- 15. The Site Health and Safety Coordinator will be responsible for ensuring proper compressors with appropriate filtration and monitoring of the compressed air are provided and that appropriate records for Grade "D" air certification are kept and that the intake of the compressor is located in an area free of any air contaminants.

2.2.1.4 Work Mission Duration

The maximum working time without a break where respiratory protection is required is 120 minutes unless an exception is approved by the CHSD. In many instances, the time without a break will be less than 120 minutes.

The length of time that respiratory protection may be worn before a break, work mission duration, is established during HASP development.

When the respirator only is considered, work mission duration is determined by need to change cartridges or canisters or duration of the air supply.

Since many other factors such as use of other PPE, hot, cold or humid environments, and exertion, are often involved beside the presence of airborne contaminants, respiratory protection use alone is seldom the only factor that limits work mission duration. The following criteria and factors must also be used:

1. Change rates for APR cartridges or canisters must be established for each HASP based on:
 - a. Hazard and risk assessment information.
 - b. Environmental factors such as heat, cold, and humidity.
 - c. Mixtures of contaminants that may affect the rated capacity of a cartridge or canister.
 - d. Experience in similar circumstances.
2. On a worst-case basis, cartridges and canisters must be changed:

- a. At the first sign of warning property break-through.
- b. When end of life service monitors indicate.
- c. When air flow resistance or heat of absorbent reaction cause undue difficulty in breathing.
- d. The canister or cartridge is damaged in such a way as to potentially effect contaminant removal ability.

Every effort must be made to avoid using worst case as a basis for cartridge or canister change.

- 3. The work mission durations will be used to reduce risk of heat or cold stress, when heat or cold is a factor.
- 4. Work mission duration when using air supplying respirators must be determined and will depend upon:
 - a. Available air supply; do not exceed two (2) hours.
 - b. Careful monitoring of remaining air supply and of time of travel from point of donning to work location to ensure sufficient air remains for safe decontamination when workers reach decontamination line.
 - c. Conformance with OP for heat/cold stress factors.

2.2.1.5 Inspection, Maintenance, Cleaning, and Storage

- 1. Equipment Stores (ES) must inspect, maintain, clean, disinfect, and store respirators according to manufacturer's direction and regulation prior to issue. Personnel providing these services may perform only those elements for which they are trained or certified.
- 2. Persons assigned respirators are trained to provide and are responsible for inspecting, maintaining, cleaning, and disinfecting their respirators, once issued from ES.
- 3. Respirators must be inspected as shown prior to use and as often as site conditions indicate.
- 4. Persons assigned respirators may provide only maintenance for which they have been trained.
- 5. Respirators will be cleaned and disinfected, at a minimum, daily and before another person may use the respirator. The frequency of cleaning will be determined by the SHSC.

6. Respirators shall be stored in a clean, safe location where they will not be contaminated, misshapen or exposed to elements that could affect the operation of the respirator.
7. Certified technicians will perform more complicated inspections and maintenance as required by the respirator manufacturer.

The Equipment Stores Manager, RSO or DSO in charge of non-Central Equipment Stores and each Site Health and Safety Coordinator is responsible for ensuring inspections are made and maintenance, repair, cleaning and disinfection is performed as required and that respirators are correctly stored.

Respirator Inspection

APR Inspection and Checkout

1. Inspect unit for obvious damages, defects, or deteriorated rubber.
2. Check that face piece harness is pliable, fasteners work easily, and that there is no sign of damage, drying or other potential cause of failure.
3. Inspect lens for damage, diminished visibility, and proper seal.
4. Exhalation Valve(s) - Remove cover(s) and check valve for debris, residue, or tears which could cause sticking or leakage.
5. Inhalation Valves - In MSA full-face respirators, the inhalation valves are in pockets and are difficult to examine. They can be inspected by removing the cartridges, looking through the opening from the cartridge holder, and feeling inside the pocket. The inhalation valves in the MSA PAPR and gas mask facepieces are in the speaking diaphragm housing and are accessed by unscrewing the breathing hose fitting from the face piece (may require a tool).

Valves must be seated properly, free of tears, debris, and residue.

6. Gaskets/"O" Rings - Inspect the cartridge holder of the MSA dual cartridge respirator and respirators using similar cartridge holders to ensure a gasket is in place to ensure a good seal. Inspect the gasket to be sure it is not dried. Make sure the speaking diaphragm retainer ring is tight.

out, cracked, or torn, and that it is seated properly. Check that gaskets in the breathing hose fittings of gas masks and PAPRs are in place and not torn, cracked, dried out, or improperly seated.

7. Make sure the speaking diaphragm retainer ring is tight.
8. Make sure the correct cartridge or canister is attached.
9. Don and perform positive, then negative pressure test:
 - a. Cover exhalation valve and gently blowing out; the mask should push away from the face evenly.
 - b. Cover inhalation ports of cartridge or canister or the end of breathing hose and inhale; a vacuum should form and draw facepiece in toward the face.
10. Inspect breathing hoses of MSA PAPRs and gas masks by stretching the hose out and observing for cuts, drying, or cracking. Cover both ends of the breathing tube and stretch; this should cause hose to deflate if there are no pin holes.

Cleaning, Disinfecting, and Storing APR's

APR's must be cleaned and disinfected; before use, prior to another persons use, and if used daily, at least once each day. The SHSC or appropriate Safety Officer determines cleaning frequency.

Cleaning Routine

The steps to be followed for cleaning and disinfecting are:

- Respirator Disassembly. Respirators are taken to a clean location where the filters, cartridges, or canisters are removed, damaged to prevent accidental reuse, and discarded. For thorough cleaning, the inhalation and exhalation valves, speaking diaphragm, and any hoses are removed.
- Cleaning. A cleaning and disinfecting solution approved by the manufacturer is used and is dissolved in warm water in an appropriate tub. Using gloves, the respirator is placed in the tub and swirled gently. A soft brush may be used.
- Rinsing. The cleaned and disinfected respirators are rinsed thoroughly in water to remove all traces of detergent and disinfectant. This is important for preventing dermatitis.
- Drying. The respirators may be allowed to dry in room air on a clean surface. They may also be hung upside down clothes, but care must be taken not to damage or distort the facepieces.

- **Reassembly and Inspection.** The clean, dry facepieces should be reassembled and inspected in an area separate from the disassembly area to avoid contamination. Inspect the respirators carefully for detergent or soap residue left by inadequate rinsing. This appears most often under the seat of the exhalation valve and can cause valve leakage or sticking.

Storage of Air Purifying Respirators

OSHA requires that respirators be stored in a clean, safe place to protect against:

- Dust, sunlight, heat, extreme cold, or excessive moisture, damaging chemicals, or mechanical damage.
- DO NOT STORE FACEPIECES WITH THE HEAD HARNESS OVER THE FRONT. NEST THE HARNESS IN THE FACEPIECE ITSELF.

SCBA Inspection & Checkout (MSA 401/Ultra-lite 30 minute units)

Monthly Inspection:

1. Check cylinder DOT label or other WESTON labels for current hydrostatic test date. (Must be within 3 years for composite and 5 years for steel cylinders.)
2. Inspect cylinder for cracks in neck, any dents or gouges in body.
3. Inspect cylinder gauge for damage, dents, cracks in bezel and to ensure the cylinder is full. Check cylinders weekly if used for emergency response.
4. Complete routine inspection described below, document inspection and recommendations, make repairs for which qualified and take faulty respirators out of service.

Routine Inspection: Monthly, immediately prior to use and after cleaning.

1. Complete steps 1 - 3 above then, before proceeding, check that the:
 - Check "O" ring on end of high-pressure hose nipple that fits into cylinder valve assembly is in place and undamaged.
 - Connect high-pressure hose tightly on cylinder.
 - Be sure by-pass and mainline valves are closed.
 - Regulator outlet is not covered or obstructed.

2. Backpack and harness assembly:

- Visually inspect straps for wear, damage, and completeness.
- Check wear and function of belt.
- Check backplate and cylinder holder for damage.

3. Cylinder and high pressure hose assembly:

- Check cylinder to ensure that it is firmly attached to backplate.
- Open cylinder valve; listen or feel for leakage around packing and hose connection.
- Check high pressure hose for damage or leaks.

4. Regulator:

- Open and close the mainline valve to ensure it works.
- Be sure there is no obstruction on or in the regulator outlet. Open and close the by-pass valve to ensure it works.
- Cover regulator outlet with hand and open mainline valve.
- Note stoppage of air flow as positive pressure builds. Compare reading on regulator gauge to cylinder gauge. They should read within 200 psi of each other.
- Remove and replace hand covering regulator outlet several times rapidly and watch regulator gauge. The needle should return to the original pressure noted, if it does not, DO NOT USE SCBA.
- Close the mainline valve and remove hand from regulator outlet.
- Cover regulator outlet with palm of hand and open mainline valve.
- Note pressure reading on regulator gauge.
- Keep hand over regulator, close cylinder valve outlet.
- Move hand slightly to allow air to bleed from the outlet and note drop in pressure. Low-pressure warning alarm should sound between 550-650 psi.
- Remove hand from regulator outlet.

- Close mainline valve.

Cleaning, Disinfecting, and Storing SCBAs & Airline Respirators

Facepieces of SCBA's must be cleaned and disinfected before use, during use and at least once daily. Back packs, cylinders, harnesses, high pressure hoses, etc, must be cleaned carefully after decontamination, according to manufacturer's instructions, to remove any decontamination fluid residue or accumulation of dust that may occur during storage or inspection. When in proper storage, cleaning interval is weekly or monthly, as appropriate.

Daily Cleaning Routine - Facepieces - MSA Ultra-Vu PP/PD SCBA

- Respirator Disassembly - Respirators are taken to a clean location. For thorough cleaning, the inhalation, speaking diaphragm, and any hoses are removed.
- Cleaning - Cleaning and disinfecting solution approved by the manufacturer is used by dissolving in warm water in a clean tub. Using gloves, the respirator is placed in the tub and swirled gently. A soft brush may be used to facilitate cleaning.
- Rinsing - Cleaned and disinfected respirators must be rinsed thoroughly in water to remove all traces of detergent and disinfectant. This is very important for preventing dermatitis.
- Drying - The respirators may be allowed to dry in room air on a clean surface. They may also be hung upside down, but care must be taken not to damage or distort the facepieces.
- Reassembly and Inspection - The clean, dry respirator facepieces should be reassembled and inspected in an area separate from the disassembly area to avoid contamination. Respirators must be carefully inspected for detergent/soap residue which appears most often under the valves, and can cause leakage or sticking.

Storage of SCBA's

1. Damage and contamination of respirators may occur if they are stored improperly. OSHA requires respirators be stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, damaging chemicals, or mechanical damage.
2. SCBA & airline/SCBA units to be used for emergency response must be stored in their cases or an approved quick access rack. SCBA units used for emergency response must have high pressure hose attached, straps and belts fully open and must be checked frequently for proper fullness.

3. In normal storage, SCBAs will be stored according to manufacturer's directions; with high pressure hose disconnected.

2.2.1.6 Respirator Decontamination

The Respiratory Protection Program for each HASP must take into account methods of preventing contamination of respiratory protective equipment, as well as methods for decontamination.

Respirators must be decontaminated, along with other PPE, as prescribed by each HASP. During decontamination, the following general procedures apply:

1. Keep respiratory protection on and functional until all other PPE, except inner (surgical) gloves, have been removed.
2. Clean and disinfect respiratory protection as soon as possible after decontamination.
3. Do not leave respirators where they may become contaminated by persons passing through the contamination reduction corridor.
4. Use decontamination techniques that minimize the use of water, strong detergents, and any solvents.
5. Protect water sensitive parts (example: regulator of SCBA) during decontamination.

2.2.1.7 Training and Fit Testing

WESTON Health and Safety Policy requires personnel to receive respiratory protection use training in authorized courses prior to being assigned to work with respirators. Employees must receive refresher training annually, and site-specific respirator use training at project start-up. See PD 11-01 and OP 11-10-006.

WESTON employees who may be assigned to use respiratory protection must receive the training described above, be given the opportunity to try on and become familiar with one of an assortment of full-face negative pressure respirators, and must pass a qualitative fit test administered according to OSHA regulation, prior to being assigned to wear a respirator in a hazardous or potentially hazardous environment.

The initial WESTON fit testing will serve as a reference fit test. The fit test must be re-affirmed no less frequently than annually. More frequent monitoring is required for emergency response activities, and asbestos site work, if an individual gains or loses 10 pounds or has dental or facial surgery.

WESTON personnel must also be quantitatively fit tested in order to use full-face negative pressure respirators for protection where OSHA Standards require quantitative fit testing (lead, asbestos, arsenic, etc.).

2.2.1.8 Donning and Doffing

With the exception of escape breathing apparatus used for emergency purposes, respirators must be donned in a safe area and not removed until back in a safe area or emergency contingency procedures require removal.

Facepieces

Donning a respirator facepiece includes:

1. Select a properly sized, clean, sanitized facepiece and, if appropriate, breathing hose.
2. Check the facepiece and breathing hose as described above.
3. Attach the cartridges and canister specified by the HASP or program to the APR facepiece or breathing hose as appropriate.

For SCBA or airline units, attach the breathing hose to the facepiece, but do not connect to regulator until just prior to opening the valve which releases air to the breathing hose.

4. Seat the chin in the chin cup of the face seal, pull harness over head, and tighten straps evenly from bottom to top.
5. Check to make sure no other item of PPE, hair containment, or hair is between the face and face seal.
6. Check in mirror or have buddy check to make sure facepiece is properly aligned.
7. Perform positive pressure check by covering exhalation valve(s) and puffing air out gently; air should not escape through face seal. If this occurs:
 - a. Tighten straps and try again until face seal is air tight.
 - b. If this makes facepiece too tight, obtain new fit test with other size facepiece or other brand.

This check is difficult with MSA positive pressure/pressure demand facepieces and may be omitted.

8. Perform negative pressure check by covering intake to cartridges, canister or breathing hose and inhaling; this should cause a vacuum and facepiece will collapse towards face. If this doesn't occur, follow steps 7a and 7b above.

SCBA - MSA 401 or Ultra-Lite Units

1. Complete pre-use inspection as described above.
2. Ensure tank is full (at least 2,200 psi), and mainline and by-pass valves are closed.
3. Open cylinder valve.
4. Donning

a. Over head method:

- (1) Open belt and back pack harness straps fully.
- (2) Place unit with facepiece detached on floor or table with cylinder down and cylinder valve pointing away.
- (3) Bend at waist, point fingers down, place one hand on each side of the cylinder inside the shoulder straps.
- (4) Remain bent at the waist and lift the unit over head and on to back, ensuring that cylinder valve is pointing down. Be careful of the swing of the regulator.
- (5) Still bent at waist, tighten shoulder straps, then slowly straighten up, tightening the straps so weight of the unit is supported as high on the shoulders as possible.

If shorter, allow weight to ride on hips. As long as shoulder straps are tight enough to keep unit from shifting, this is acceptable.

The goal is to avoid/minimize carrying weight on the lower back.

- (6) Buckle waist belt and tighten, position regulator so comfortable, attach safety strap if possible.
- (7) Check hood of coveralls or splash suit to ensure it is not caught in or under the unit.

(8) Just before entry, check and don facepiece as shown above, then:

- Hold end of breathing hose in left hand.
- Put right hand on mainline valve.
- Inhale normally and hold breath.
- Turn on mainline valve, exhale, begin breathing as normally as possible, and continue to open valve fully, then back slightly.
- Tighten the breathing hose connector.
- Check pressure on regulator gauge; have safety watch record time air use began and begin entry.

b. Donning - Over coat method:

- (1) Open belt and back pack harness straps fully,
- (2) Place unit with facepiece on floor or table with cylinder down, cylinder valve pointing toward you, alternately have someone hand the unit to you.
- (3) Grasp right shoulder strap with right hand, or left with left hand, bend slightly at waist.
- (4) Remain bent at the waist and pull unit over arm holding the strap, then insert other arm in other strap, ensuring that cylinder valve is pointing down. Be careful of the swing of the regulator.
- (5) Still bent at waist, tighten shoulder straps, then slowly straighten up, tightening the straps so weight of the unit is supported as high on the shoulders as possible. If shorter, allow weight to ride on hips. As long as shoulder straps are tight enough to keep unit from shifting, this is acceptable. The goal is to avoid/minimize carrying weight on the lower back.
- (6) Buckle waist belt and tighten, position regulator so comfortable, attach safety strap if possible. (Some models have short safety straps that preclude use.)
- (7) Check hood of coveralls or splash suit if appropriate to ensure it is not caught in or under the unit.
- (8) Just prior to entry, checkout and don facepiece as shown above.

(9) When ready to "go on air":

- Hold end of breathing hose in left hand.
- Put right hand on mainline valve.
- Inhale normally and hold breath.
- Turn on mainline valve, exhale (begin breathing as normally as possible from the supplied air), and continue to open valve fully, then back 1/4 turn.
- Tighten the breathing hose connector.
- Check pressure on regulator gauge; have safety watch record time air use began and begin entry.

Doffing Respiratory Protection

Doffing an APR

1. Doff APR only after:

- Leaving the exclusion zone or regulated area.
- Decontamination has been completed.
- A safe area is reached, and
- All other PPE except inner gloves have been removed.

2. Doff the respirator facepiece by:

- Loosening the harness straps.
- Grasping the front and lifting up and away from face without touching the face.

3. Remove canister or cartridges and place in clean area if to be reused or dispose of it according to the SHSC's direction.

4. Place facepiece in proper container for further cleaning or sanitizing. DO NOT PLACE FACEPIECE WHERE IT MAY BE CONTAMINATED NOR HANG OR STORE IN SUCH A WAY AS TO DISTORT FACEPIECE MATERIAL.

5. Wash hands thoroughly before touching the face.

6. Complete cleaning and sanitizing. Store in a clean safe place.

Doffing an SCBA unit

1. Doff SCBA only after decontamination is completed to the point where:

- All other PPE except inner gloves are removed.
- Disconnection from the air supply is safe.
- The appropriate removal station is reached, then:

- a. Loosen breathing hose fastener on regulator.
- b. Begin turning off main line valve.
- c. Grasp end of breathing hose near regulator.
- d. When air flow stops, lift hose from regulator.
- e. Hold hose away from body and doff facepiece as indicated in above in steps 1 - 4.

2.2.1.9 Respirator Use Monitoring and Work Place Surveillance

The WESTON Respirator Use Monitoring and Work Place Surveillance Program for tasks involving the use of respiratory protection takes into account:

1. Respiratory Protection Program Evaluation:

- PPE Plan is evaluated to ensure that respiratory protection is appropriate and that use of other PPE does not affect the proper use of respiratory protection.
- Air monitoring and sampling must be performed to confirm the lack of need for or the need for respiratory protection. The HASP defines appropriate air sampling and monitoring for each project, program, and activity. Even if respirators are worn, an air monitoring program consisting of, as a minimum, use of direct reading instruments and, as necessary, air sampling to identify specific airborne contaminants and concentrations is required.
- Program auditing by the SHSC, Division or Region Safety Officers and Corporate Health and Safety to ensure HASPs are being implemented accordingly.

2. Respiratory Protection Program Implementation:

- A Site Health & Safety Coordinator experienced in use of the respiratory protection, used and certified according to OSHA, is assigned to every site with the specific responsibility of implementing the approved HASP, including the enforcing of use of respiratory protection and constantly evaluating the PPE program to ensure it is correct for the conditions. Any change in the PPE Plan must also be approved.

3. Respiratory Protection Program Special Requirements:

- A safety watch and/or buddy system, as described above, must be used whenever respiratory protection is required. The buddy or safety watch must:
 - a. Monitor for signs of fatigue, heat, or cold stress.

b. Help keep track of:

- Air supply duration.
- Time until canister/cartridge change.
- Airline position relative to potential for prolonged contaminant contact or presence of physical hazard to the airline.

c. Be observant for changing or hazardous conditions.

d. Maintain communication with entry team, buddy or command post.

2.2.1.10 Program Evaluation

WESTON's respiratory protection program includes a number of different types of evaluations and inspections:

- Initial Evaluation - Review of project needs and assignment of Respiratory Protection Program.
- Re-evaluation - Review of Respirator Protection Program upon expiration date of HASP.

In addition, the WESTON Medical Monitoring Program is designed to be sufficiently comprehensive and sensitive enough to serve as an evaluation of the effectiveness of the WESTON Health and Safety Program.

2.2.2 Subcontractor Respiratory Protection Program

WESTON subcontractors must have acceptable respiratory protection programs.

1. WESTON requires certification that subcontractor employees are be medically qualified to work and to wear a respirator, prior to assignment to any job involving respirator use. WESTON's minimally acceptable respirator program for subcontractors is full conformance with OSHA and ANSI Standards.
2. Subcontractors must provide proof of fully conforming medical certification programs.
3. Subcontractors must provide proof of recent fit tests for respirators to be used prior to beginning work on any site requiring or potentially requiring respiratory protection use.
4. WESTON employees and subcontractors must provide documentation that they are trained in the use of respirators to be used, prior to being assigned to work in any activity requiring use of a respirator.

5. WESTON subcontractor employees must provide proof of having been fit tested within the past 12 months, using, as a minimum, qualitative fit testing protocols or at the interval required by regulation whichever is more protective.

Quantitative fit testing is required for special situations, i.e., using a full face negative pressure respirator for protection from asbestos, lead, arsenic, etc.

APPENDIX 7-E

HEALTH AND SAFETY PLAN AGREEMENT FORM

**HEALTH AND SAFETY PLAN
TECHALLOY RFI
TECHALLOY COMPANY, INC.
UNION, ILLINOIS**

April 1993

Prepared by: _____ Date: _____
Jennifer A. Force
WESTON Geologist

Approved by: _____ Date: _____
Carlos J. Serna, P.G.
WESTON Project Manager

Approved by: _____ Date: _____
John W. Thorsen, P.E.
WESTON Project Director

Approved by: _____ Date: _____
Deane E. Walker, CSP
WESTON DSO/RSO

Approved by: _____ Date: _____
George M. Crawford, CIH
WESTON Corporate
Health and Safety Director

Work Order No. 01989-009-001-0030

**Techalloy Site
Union, Illinois**

[illegible]

APPENDIX 7-F

HNu/OVA/HCN OPERATION, MAINTENANCE, AND CALIBRATION PROCEDURES



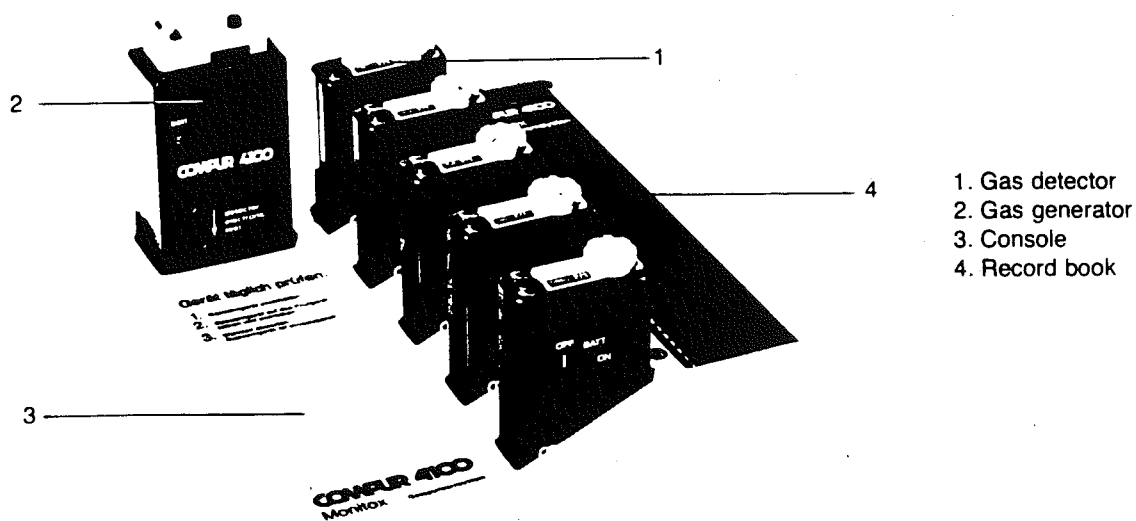
Gas Detector and Warning System

COMPU 4100

Monitox

[H₂S, HCN, NO₂, COCl₂]

Operating Instructions



2

The COMPUR 4100 Gas Detector and Warning System

The Compur 4100 Gas Detector and Warning System comprises

a gas detector (a warning unit)
a gas generator (a testing unit)
a console and
a record book.

The system is designed in particular to monitor the threshold limit value (TLV).

In accordance with the German list of TLV values, the following gas concentrations are permissible:

Hydrogen sulphide H_2S	= 10 ppm
Hydrocyanic acid HCN	= 10 ppm
Nitrogen dioxide NO_2	= 5 ppm
Phosgene $COCl_2$	= 0.1 ppm.

1.

The Compur 4100 Gas Detector

Approved safety classes

Ex i, s, G5

Please observe the following regulation:

"The instrument must not be open or opened in areas containing firedamp or in areas prone to explosion."

The nameplate (8) on the filter cap (5) bears the following information:

the chemical formula of the gas to which the detector responds and the TLV of the gas (eg HCN -TLV).

4

1.1

Technical Data and Remarks

Dimensions:

4 1/8" x 2 7/16" x 1 5/16" (104,5 x 62 x 24 mm)

Weight with batteries:

approx. 150 g

Power supply:

2 x 2.7 V encapsulated Varta-Mercury batteries

Battery service life:

approx. 2000 hours of operation and 1 hour of audible alarm

Alarm volume:

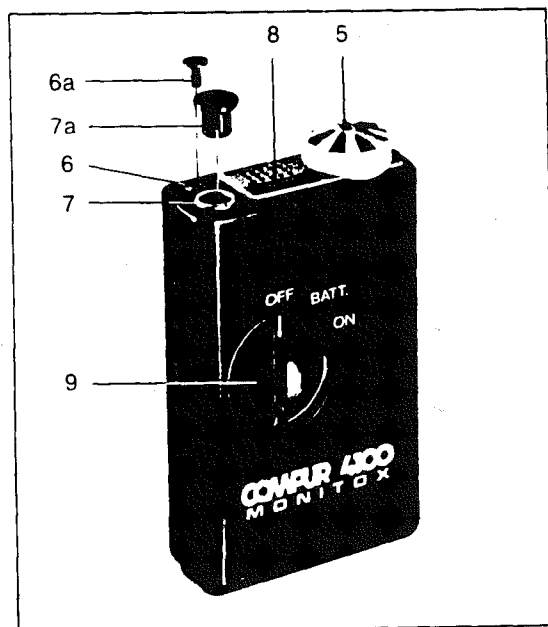
at least 80 dB at a distance of 12" (30 cm)

Temperature range:

0°C to +45°C

Sensor cell service life:

about 6 months during normal operation



- 5 Filter cap
- 6 Earphone jack
- 6a Earphone jack cap
- 7 Socket for dosimeter connection
- 7a Cap for socket 7
- 8 Nameplate
- 9 On-off switch

5

Alarm Threshold

The gas detectors are set at the following TLV values:

H₂S = 10 ppm
HCN = 10 ppm
NO₂ = 5 ppm
COCl₂ = 0.5 ppm.

Response Time

n	t _A
1	...
2	approx. 60 sec
3	approx. 10 sec
5	approx. 2 sec
10	approx. 1 sec

The alarm threshold can also be set at a different value upon request.

t_A = the time until the alarm is triggered

n = gas concentration expressed as a multiple of the alarm threshold

6

Cross Sensitivity

Cross sensitivity is defined as the response of a detector sensor cell to a gas other than the specific gas indicated on the nameplate.

When a particular concentration is reached, other gases will also trigger an alarm due to cross sensitivity.

Gas indicated on detector nameplate	Cross sensitivity for other gases
H ₂ S	HCN 50 ppm HCl 100 ppm Cl ₂ 50 ppm
HCN	H ₂ S 2 ppm HCl 20 ppm Cl ₂ 10 ppm
NO ₂	O ₃ 50 ppm
COCl ₂	HCN 0.5 ppm

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The COCl_2 detector is equipped with an activated charcoal filter which absorbs H_2S , HCl and Cl_2 . This eliminates the cross sensitivity to these gases and the instrument will not sound an alarm.

If the COCl_2 detector, however, has been subjected to such high concentrations of one of the three above-mentioned gases that the filter capacity has been exhausted, the generator will then trigger an alarm for these gases as well. Replace the COCl_2 filter cap immediately (see Sect. 1.4).

CAUTION: All reactive gases in a concentration 100 times higher than the alarm threshold will irreparably damage the sensor cell. If this happens, replace the sensor cell prematurely (see Sect. 1.4).

8

Regeneration Time

Regeneration time is defined as the time required for the alarm to cease once the detector has been removed from the location of high gas concentration. The regeneration time is dependent on the gas concentration acting on the sensor cell. If this concentration is very high, the regeneration time may even amount to several hours. If the concentration is 100 times higher than the alarm threshold, the sensor cell can be damaged irreparably.

If this happens, the detector will sound a continuous alarm. The filter cap and the sensor cell must be replaced (see Sect. 1.4).

n	t_R
2	approx. 2 sec
3	approx. 5 sec
5	approx. 20 sec
10	approx. 120 sec

n = gas concentration expressed as a multiple of the alarm threshold

t_R = regeneration time

1.2

Using the Gas Detector

The person to be protected must wear the gas detector near his head. Do not cover up the filter cap.

If possible, protect the filter cap from dripping water and dust-laden air.

Before using the detector, test it as described in Section 1.3. If there is any toxic gas where the appropriate detector is being used and if the gas concentration in the vicinity of the gas sensor exceeds the TLV value, the detector will emit an alarm after a delay which is dependent on the concentration (see Sect. 1.1).

The undulating signal has a volume of at least 80 dB at a distance of 12" (30 cm).

The alarm can also be triggered by other gases if they are present in a sufficiently high concentration. This is termed cross sensitivity and is explained in Section 1.1.

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Earphones

If there is a great deal of noise where the detector is being used, use earphones so that you do not overhear a possible alarm. Connect the earphones to the jack (6). This disconnects the internal loudspeaker. If you are planning to use earphones, then you should test the gas detector (see Sect. 1.3) in conjunction with the earphones. When the earphones are no longer needed, replace the stopper (6a) in the jack.

11

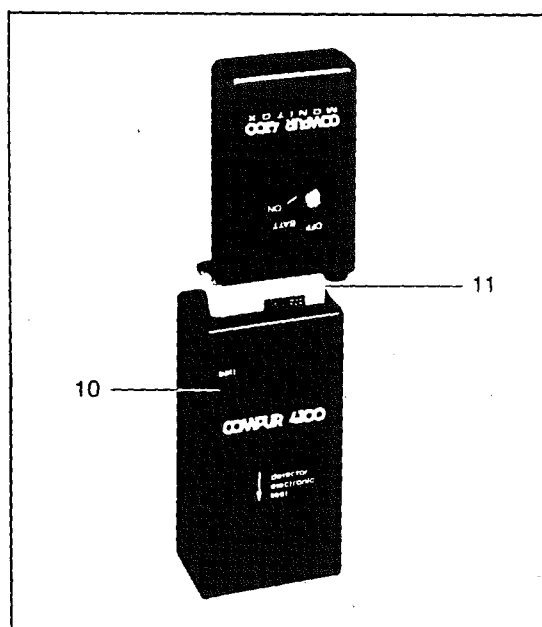
1.3

Gas Detector Test

Before using the gas detector, test its functional reliability as follows. Turn the switch to the "ON" position and place the detector on top of the gas generator as shown on page 13. Make sure that the nameplate of the gas generator matches that on the gas detector. Placing the detector on top of the generator causes the actuating pin (11 in the figure on page 22) to switch on the generator, thereby generating the gas. The gas detector will emit the alarm signal after a brief delay. Remove the detector from the generator **immediately** as soon as you hear the alarm signal. After the test leave the switch in the "ON" position.

Record the test and the person to whom the generator is issued in the record book (4). If the red battery check lamp (10) lights up during the test, replace the generator batteries (see Sect. 2.2). If the filter cap (5) is clogged with dirt, the alarm may not be emitted. Replace the filter cap (see Sect. 1.4).

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Battery Test

Turn the switch (9) to the "BATT" position. An undulating audible signal will be heard if the battery capacity is still adequate for another 8 hours of operation.

If no signal is heard, replace the batteries. Perform this test only briefly in order to save power.

Battery replacement:
see Section 1.4.

10 Battery check lamp
11 Actuating pin

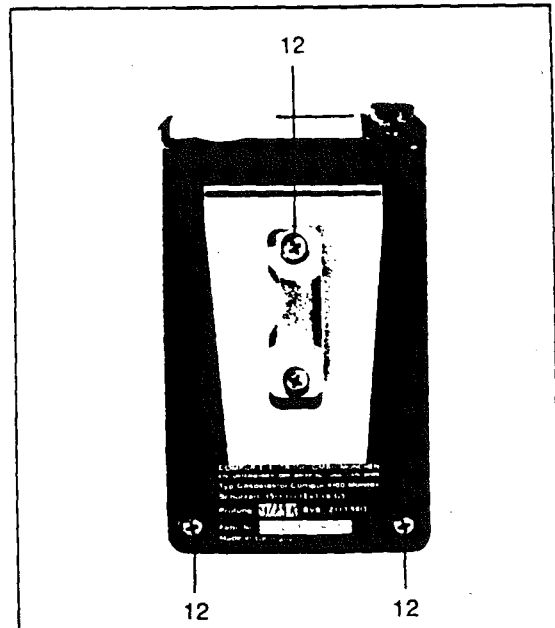
13

1.4

Servicing Instructions

See Section 3 for refills and replacement parts.

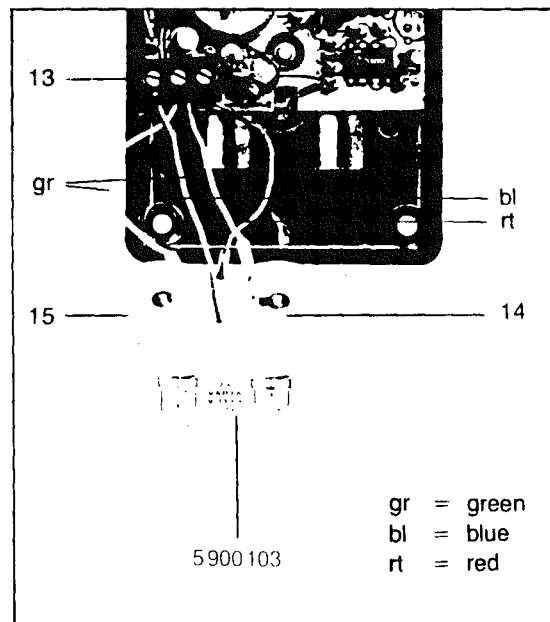
Gas Detector, rear view



14

Battery Replacement

1. Turn the switch (9) to "OFF".
2. Remove the three screws (12).
3. Turn the detector over and remove the front panel of the housing.
4. Lift out the battery block and loosen the screws (13).
5. Unscrew and remove the right battery cover (14). Replace the battery. The + pole must face the cover. Screw the cover back into place.
6. Repeat step 5 with the left battery. The — pole must face the cover (15).
7. Reattach the leads matching the colours (blue, green, red) with those on the clamp terminals.
8. Replace the battery block and the front housing panel and screw into place.
9. Repeat the battery test.



**USER'S MANUAL TO THE
PORTABLE ORGANIC VAPOR ANALYZER**

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**USER'S MANUAL TO THE
PORTABLE ORGANIC VAPOR ANALYZER**

3.

Accessories and Replacement Parts



Accessories

Catalogue No.

Console for 5 detectors and
1 generator including record
book

5900 001

Earphones

5900 002

Earphone jack stopper

5900 007

Replacement Parts

Catalogue No.

2.7V Varta-Mercury battery
Set of batteries (2 batteries)
in an intrinsically safe
battery case, with terminals
Record book

U 5900 003

U 5900 103

U 5900 004

Gas Detector Sensor Cells
with Filter for:

hydrogen sulphide H_2S

U 5800 141

phosgene $COCl_2$

U 5800 212

hydrocyanic acid HCN

U 5800 341

nitrogen dioxide NO_2

U 5800 431

Gas Generator Cells for:

hydrogen sulphide H_2S

U 5820 100

phosgene $COCl_2$

U 5820 200

hydrocyanic acid HCN

U 5820 300

nitrogen dioxide NO_2

U 5820 400

Gas Detector Filter Caps

10 caps with filter for:

hydrogen sulphide H_2S

U 5810 141

phosgene $COCl_2$

U 5810 212

hydrocyanic acid HCN

U 5810 341

nitrogen dioxide NO_2

U 5810 431

2.

Compur 4100 Gas Generator

The Compur 4100 Gas Generator must **not** be stored or used in areas containing firedamp or in areas prone to explosion.

The gas generator is designed to test the functional reliability of the gas detectors. The gas generator, however, is not designed to generate gas continuously. When testing, make sure that the gas on the generator nameplate matches the gas designated on the detector nameplate. The gas generator is actuated by the actuating pin (11) when the gas detector is placed on top of the generator.

The detector will repond after no more than 8 seconds at room temperature. Remove the detector when the signal is heard. If no signal is forthcoming discontinue the test after approximately 10 seconds

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2.1

Technical Data and Remarks

Service life of the generator cell:
normally 1½ years (2500–3000 tests)
for H₂S, HCN, NO₂, COCl₂

Dimensions:
5¼" x 2⅞" x 1⅞" (133 x 65 x 40 mm)

Weight with batteries:
approx. 250 g

Temperature range:
+10° to +45°C

Power supply:
Mallory type 1604 9V battery

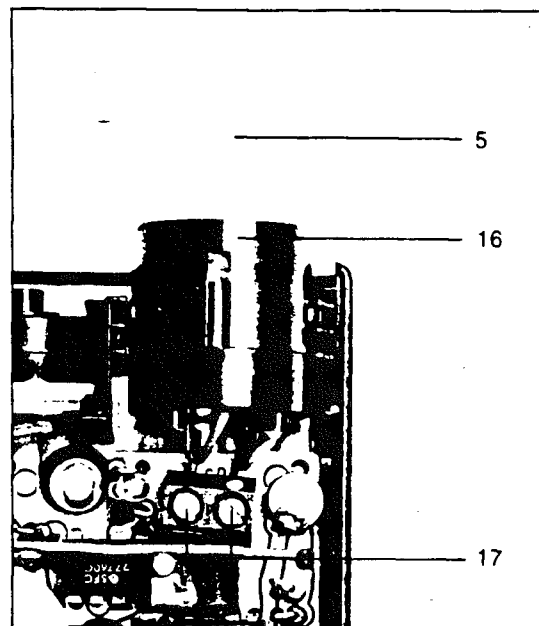
Battery service life:

The battery capacity is sufficient for 2500–3000 tests for H₂S, HCN and NO₂ and for approximately 500 tests for COCl₂. If the red lamp (10) lights up during the test, the battery must be replaced (see Sect. 2.2). If the lamp flashes during the test, this is of no importance whatsoever.

Filter Cap Replacement

1. Remove the screws (12) (see page 14) and open the detector.
2. Carefully remove the sensor cell (16) together with the filter cap (5). Pull off the cap.
3. Attach a new filter cap (with a matching nameplate) and return the sensor cell to its original position (see the figure on page 17).
The filter cap order number appears on the plate attached to the inside of the front panel and is listed in Section 3.
4. Replace the front housing panel and screw into place.
5. Repeat the test.

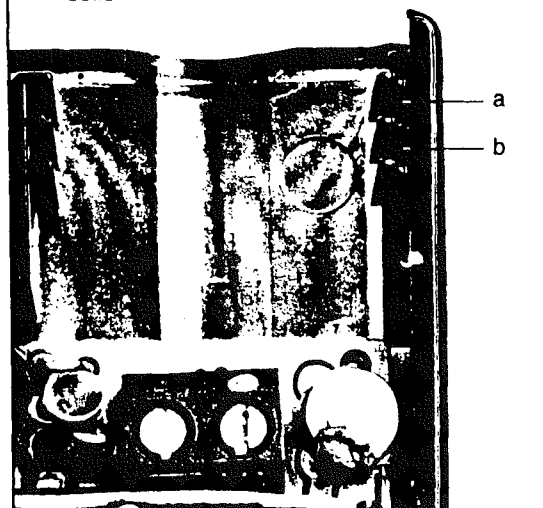
16



Sensor Cell Replacement

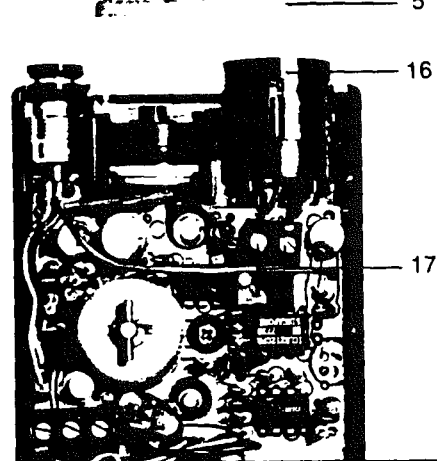
1. Open the detector (as described for battery replacement).
2. Loosen the screws (17).
3. Lift out the cell together with the filter cap.
4. Electronic test see page 19.
5. Remove the new cell and filter cap from the storage container, pull the transparent protective cap off the cell and replace this with the new filter cap. The correct positioning of the filter cap is shown on page 18. Remove the short-circuit protection attached to the leads.
6. Reattach the leads of the cell matching the colours and tighten the screws (17).
7. Slide the sensor cell into the proper groove as shown in the drawing on page 17.
8. Replace the front housing panel and screw it into place.
9. Test the detector again as described in Section 1.3.

- a) Groove for the COCl_2 sensor cell
b) Groove for the H_2S , NO_2 and HCN sensor cells



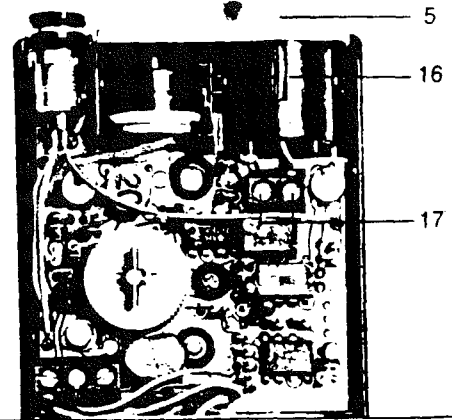
17

The filter cap and sensor cell in the gas detector showing the proper mounting of the sensor cell for COCl_2 . Cells for H_2S and HCN are fixed in the lower groove!



18

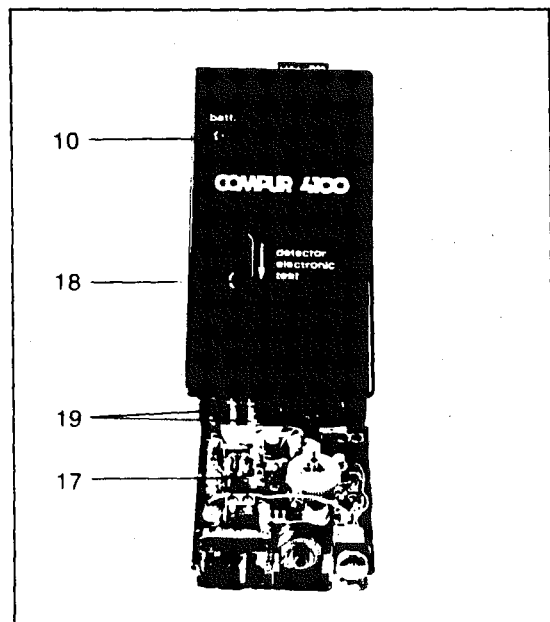
The filter cap and sensor cell in the gas detector showing the proper mounting of the sensor cell for NO_2 .



Electronic test of the detector

As stipulated below, the electronic of the detector have to be tested with the gas generator, when the sensor cell (16) is removed:

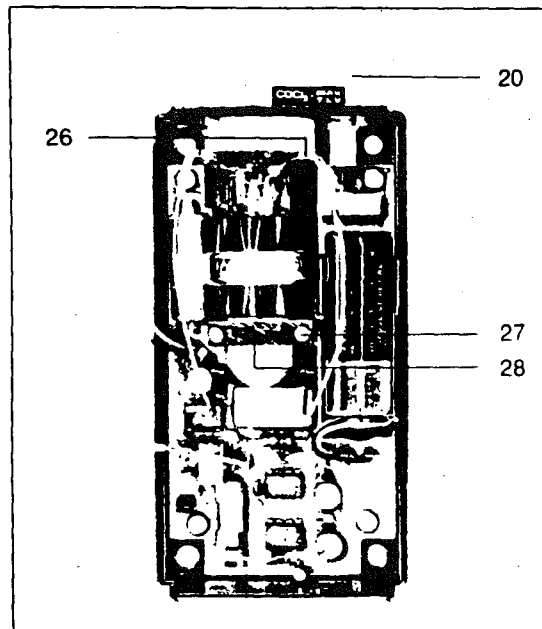
Lift out the two test pins (19) with the slide (18) and attach them to the fixing screws (17) of the sensor cell light wire. Pay attention to the colour marking blue and red of the pins and screws! When the electronics are functioning correctly, an alarm is emitted with the switch in the „ON“ position.



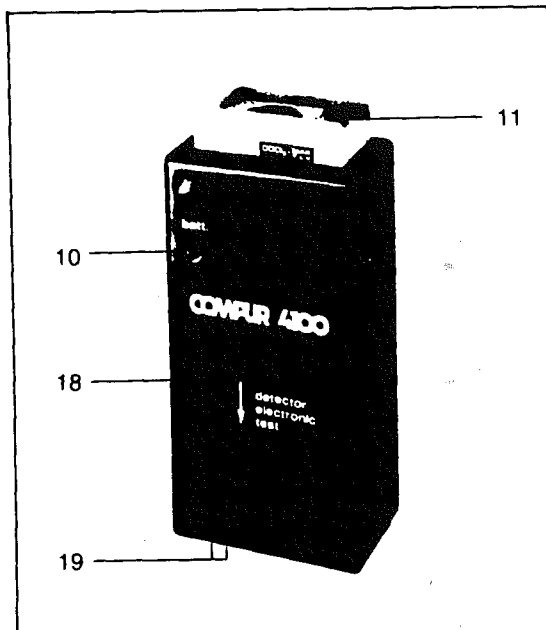
19

**Gas Generator Cell Replacement
Phosgene Generator (COCl_2)**

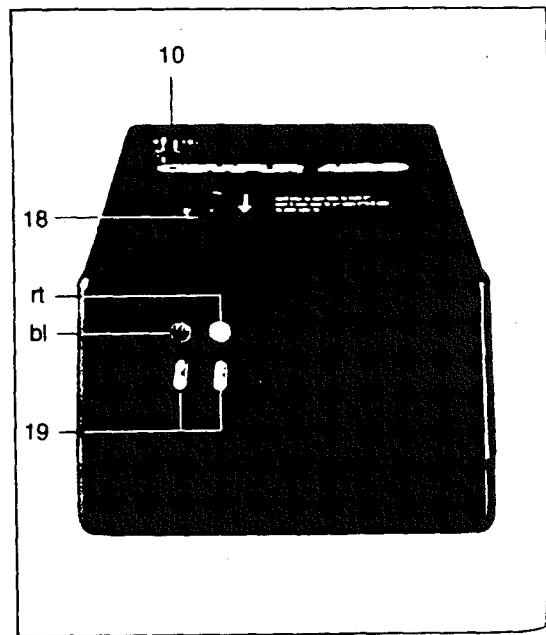
1. Open the housing as described in the section entitled "Battery Replacement".
2. Slide back the two insulating sheaths (26) to expose the cell terminals. Unsolder the wire leads.
3. Loosen the screws (27) and remove the clamp (28).
4. Remove the gas cell towards the rear.
5. Insert a new cell 5820200 into the rubber ring.
6. Resolder the leads (the pole connexion is arbitrary) and slide the insulating sheaths (26) back into place on the two terminals.
7. Secure the cell with the clamp (28) in such a way that, when inserted, the neck of the cell is flush with the recess in the orange air intake (20) or projects by not more than $\frac{3}{16}$ " (0,5 mm).



8. Reassemble the front and rear housing panels and screw them into place with the four screws.
9. Testing the generator:
Use a properly functioning COCl_2 gas detector (see Sect. 1.3). Turn the detector switch to the "ON" position and place it on top of the generator. This depresses the actuating pin (11) and produces gas. The detector must emit an alarm after a brief delay.



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2.2

Servicing Instructions

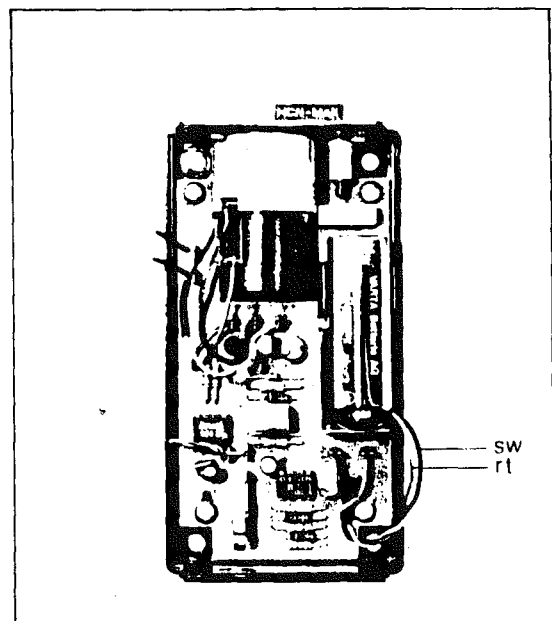
See Section 3 for refills and replacement parts.

Battery Replacement

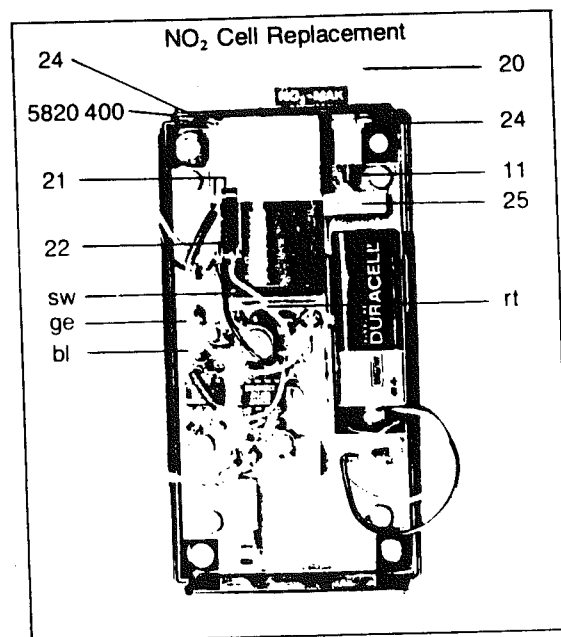
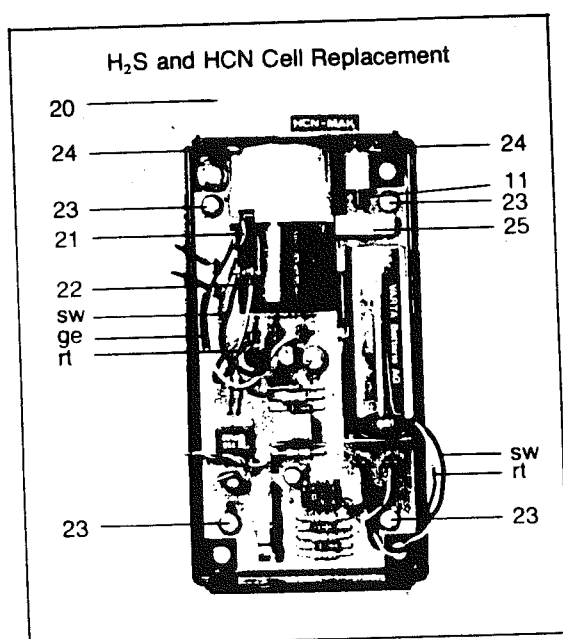
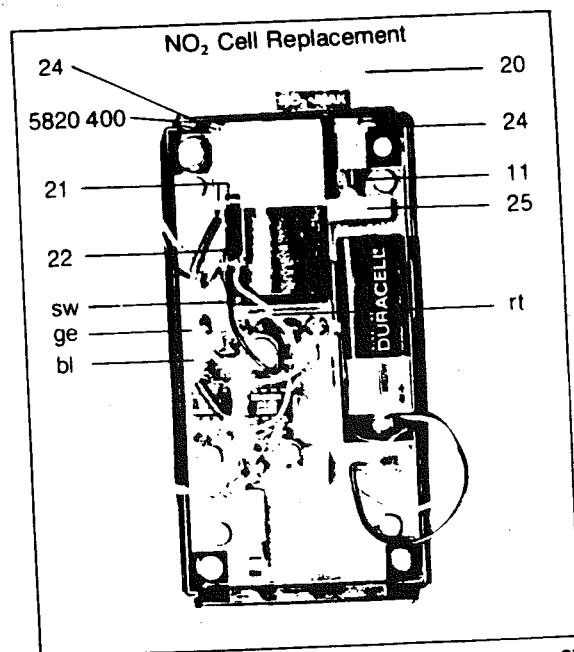
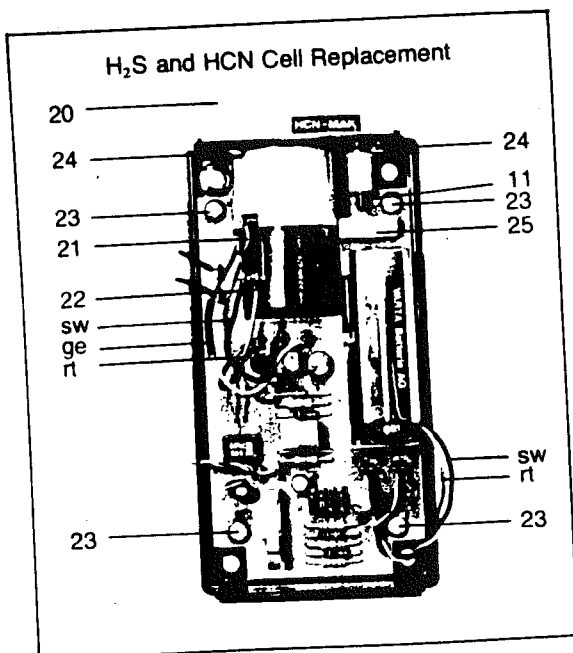
Remove the four screws on the rear housing panel. Carefully remove the front housing panel. The illustration shows the battery properly mounted.

- 10 Battery check lamp
- 11 Actuating pin
- 18 Slide
- 19 Test pins

- sw = black + white
- rt = red
- bl = blue



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Guarantee

Compur-Electronic GmbH as well as the company's foreign and domestic representatives guarantee within the framework of the general terms of trade the proper functioning of your **Compur 4100 Monitox** Gas Detector and Warning System for a period of 12

months. This guarantee does not cover the gas detector sensor cells nor the batteries.

The guarantee shall take effect on the date of delivery. It is not transferable.



MDA SCIENTIFIC, INC

1815 Elmdale Avenue
(312) 998-1600

Glenview, Illinois 60025
Telex: 72-6399 MDA-GLVN

2.82-1'

Servicing Dates for Sensor Cell Replacement

Supplementary parts order, Serial No.:
Supplementary parts order expires on:
Replace the sensor cell every 6 months.

Detector No.	Gas	Cell Replacement						
		1	2	3	4	5	6	
								Next replacement due on
								Cell replaced on by
								Next replacement due on
								Cell replaced on by
								Next replacement due on
								Cell replaced on by
								Next replacement due on
								Cell replaced on by

Enter the cell replacement due dates (every 6 months) beginning with the date the detector begins operation.

Do not forget to renew the supplementary parts order in due time.

A. INTRODUCTION TO THE OVA

The Organic Vapor Analyzer (OVA) measures trace quantities of organic compounds in the air by using ionization as the detection method. The ionization is caused by a hydrogen flame within the flame ionization detector. As the compound is ionized, the ions pass through two charged plates whereby the conductivity is measured and this current is then displayed on an external meter.

The OVA can operate in two modes:

1. Survey Mode

A sample of ambient air is routed through the OVA into the detector, allowing all organic species to be ionized and detected at the same time. The OVA analyzes total organic vapor concentrations on a continuous sampling basis and reports the results on the basis of sensitivity of the instrument to various compounds as compared to the calibration gas methane. When the OVA is calibrated to methane, the instrument is sensitive to .1 ppm.

2. Gas Chromatography Mode

When there is a mixture of organic vapors present or when qualitative and quantitative identification of a compound is necessary, then the OVA can be operated in the GC mode. the

OVA can analyze air samples in the GC mode through general survey, syringe injection, or through the use of collector tubes.

The components to be separated are carried through a column packed with an inert solid. The different components of the sample migrate through the column at different rates (retention times) and can be identified by comparing their retention time to a known standard.

The OVA is more sensitive to hydrocarbons than to any other class of organics. Compounds containing oxygen, such as alcohols, ethers, aldehydes, phenols and esters, give a lower response than that observed for hydrocarbons. Also, compounds containing nitrogen and halogenated compounds show a lower relative response as compared with hydrocarbons. The OVA gives the lowest response for materials containing no hydrocarbon and it is also limited in detecting compounds with high molecular weight. Listed below is a table indicating the relative response of compounds as compared to the calibration gas methane.

<u>Relative Compound</u>	<u>Response</u>
Methane	100
Ethane	90
Propane	64
n-Butane	61
n-Pentane	100
Ethylene	85
Acetylene	200
Benzene	150
Toluene	120
Acetone	100
Methyl ethyl ketone	80
Methyl isobutyl ketone	100
Methanol	15
Ethanol	25
Isopropyl alcohol	65
Carbon tetrachloride	10
Chloroform	70
Trichloroethylene	72
Vinyl chloride	35

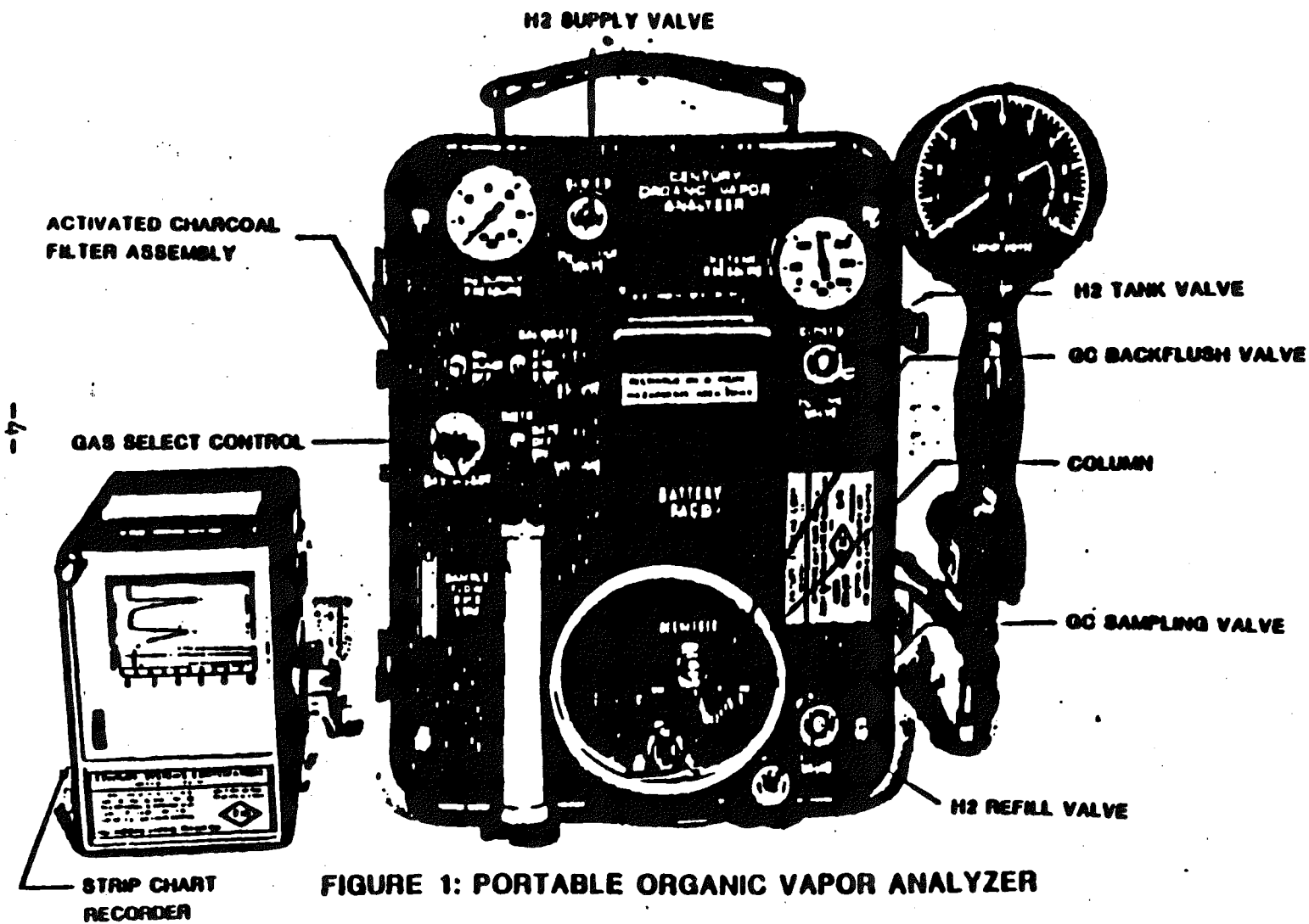


FIGURE 1: PORTABLE ORGANIC VAPOR ANALYZER

B. OPERATION OF THE OVA

Turn On Procedure

1. Move INSTR switch to ON and allow five minutes for warm up. See Figure 1 for illustration of instrument panel.
2. To set the audible alarm to a predetermined level, turn the PUMP switch to ON and adjust the meter pointer to the desired alarm level by using the CALIBRATE ADJUST (zero) knob. Turn the Alarm Level Adjust knob on the back of the Readout Assembly until the audible alarm just comes on. Adjust the speaker volume with the VOLUME knob. The instrument is then preset to activate the alarm when the level exceeds that of the setting.
3. Move the CALIBRATE switch to X10 and adjust the meter reading to zero with the CALIBRATE ADJUST knob.
4. Confirm the PUMP switch is on and observe the SAMPLE FLOW RATE indicator. Indication should be approximately 2 units.
5. Open the H₂ TANK VALVE and the H₂ SUPPLY VALVE one turn each and observe the reading on the H₂ TANK PRESSURE indicator.

Approximately 150 psi is needed for each hour of operation.

6. Open the H₂ supply valve one-half to one turn and observe the reading on the H₂ supply indicator. The pressure should be around 10 psi when operating.

CAUTION: Do not leave the H₂ SUPPLY VALVE open when the pump is not running as this will allow hydrogen to accumulate in the detector chamber.

7. Confirm that the meter is still reading zero (re-adjust if required).
8. Depress igniter button. There will be a slight "pop" as the hydrogen ignites and the meter pointer will move upscale. Immediately after ignition, release the igniter button. Do not depress igniter button for more than 6 seconds at a time. If the burner does not ignite, let the instrument run for several minutes and try again. After ignition, the meter pointer will indicate the background concentration. Use the CALIBRATE ADJUST knob to zero meter again and null the background reading.

9. Move the instrument to an area where you think the cleanest air to be surveyed is present. Move the CALIBRATE switch to X1 and adjust the meter to read 1 ppm with the CALIBRATE ADJUST knob. This permits minor downward fluctuations in the normal background level without dropping below zero, which would actuate the flame-out alarm. It is important, therefore, to remember that 1 ppm must be subtracted from all readings, e.g., a reading of 1.8 ppm would actually be 0.8 ppm.
10. If the alarm level is to be set above the normal background detection level, turn the Alarm Level Adjust knob on the back of the Readout Assembly until it activates slightly above background. The instrument is now ready for use.

Operation Procedures for Survey Mode

When using the OVA in the Survey Mode, ensure that the SAMPLE INJECT VALVE is in the FULL OUT position and that the BACKFLUSH VALVE is in either FULL IN or FULL OUT position.

1. Set the CALIBRATE switch to the desired range. Using one hand operation, survey the areas of interest while observing the meter and/or listening for the audible alarm. For broad surveys

outdoors, the pickup fixture should be positioned several feet above ground level. When making a quantitative reading or pinpointing a contaminant, the pickup fixture should be positioned at the point of interest.

2. When organic vapors are detected, the meter pointer will move upscale and the audible alarm will sound when the preset point is exceeded. The frequency of the audible alarm will increase as the detection level increases.
3. If the flame-out alarm is actuated, confirm that the pump is running; then, press the igniter button. Under normal conditions, flame-out results from sampling a gas mixture that is above the lower explosive level which causes the H_2 flame to extinguish. If this is the case, re-ignition is all that is required.

Another possible cause for flame-out would be restriction of the sample flow line which would not allow sufficient air into the chamber to support combustion of the H_2 flame. The usual cause for such restriction would be a clogged particle filter or other restriction in the line.

Remember that the chamber exhaust port is on the bottom and blocking it with the hand will cause fluctuations and/or flame-out.

Operating Procedures for GC Mode

To use the OVA in the GC (Gas Chromatograph) mode, place the Sample Inject Valve in the "in" position and turn on the unit as described in this section. Place the BACKFLUSH VALVE in the IN position and leave the hydrogen fuel and pump on for three to four minutes before attempting ignition to allow the hydrogen to purge the column.

A strip chart recorder, called a chromatogram, is usually used to record the output concentration from the OVA as a function of time. Figure 1 shows the GC option and strip chart recorder. The following procedures are for operation of the chromatograph:

Turn on the recorder and push the Sample Inject valve in with a fast, positive motion. This starts the GC analysis which is automatic until the unit is backflushed. To inject a sample, use an air-tight syringe to draw a predetermined amount of the sample gas into the syringe. Insert the syringe into the column

and inject the sample. Occasionally, the flame in the Flame Ionization Detector (FID) may go out, which would be indicated by a sharp and continued drop of the concentration level. If this occurs, simply re-ignite the flame and continue the analysis. A negative peak typically occurs shortly after sample injection and should not be confused as flame-out. The negative air peak and various positive compound peaks will be indicated on the OVA read-out meter and the strip chart recorder, which represents the chromatogram of the analysis.

After the analyses are complete, rapidly move the Backflush Valve to the out position. Leave the instrument in this position until the backflush peak printed on the recorder returns to baseline; then, return the backflush valve to the "in" position. The OVA is now ready for injection of another sample into the GC system.

Shut-Down Procedures

1. Close H₂ supply valve. Do not tighten the valves down too hard because the Teflon seats are very fragile.

2. Close H₂ tank valve and H₂ Supply valve.
3. Move INSTR switch to OFF.
4. Wait 5 seconds and move PUMP switch to OFF.

C. REFUELING THE OVA

The instrument should be completely shut down during hydrogen tank refilling operations. The tank should be refilled in a ventilated area. There should be no flame or other potential ignition source in the area.

If you are filling the instrument for the first time, or if the filling hose has been allowed to fill with air, THE FILLING HOSE SHOULD BE PURGED WITH N₂ OR H₂ PRIOR TO FILLING THE INSTRUMENT TANK. This purging is not required for subsequent fillings.

- o To connect the supply tank to the instrument, first attach the filling hose assembly to the supply tank if it is not left on the tank between fillings. Ensure that the FILL/BLEED valve on the instrument end of the hose is in the OFF position. Connect the hose to the refill connection on the Side Pack Assembly.

BEFORE FILLING THE HYDROGEN TANK, BE SURE TO HAVE THE H₂ TANK VALVE AND H₂ SUPPLY VALVE CLOSED ON THE INSTRUMENT TO PREVENT DAMAGE TO THE PRESSURE REGULATORS.

- o Open the hydrogen supply bottle valve slightly. Open the REFILL VALVE and the H₂ TANK VALVE on the instrument panel and turn the FILL/BLEED valve on the filling hose assembly to FILL. The pressure on the instrument tank will now be indicated on the H₂ TANK PRESSURE indicator.
- o After the instrument tank is filled, shut off the REFILL VALVE on the panel, the FILL/BLEED valve on the filling hose assembly and the hydrogen supply bottle valve.
- o Bleed the filling hose to atmospheric pressure by turning the FILL/BLEED valve on the filling hose assembly to the BLEED position. After the hose is bled to atmospheric pressure, turn the FILL/BLEED valve to the FILL position to allow the hydrogen that is trapped in the connection fittings to go into the hose

assembly. Then, bleed the hose again.

- o Turn the FILL/BLEED valve to OFF to keep the hydrogen at one atmosphere in the hose so that at the time of the next filling, there will be no air trapped in the filling line. If possible, leave the filling hose assembly attached to the supply tank.
- o Close the H₂ TANK VALVE.
- o With the H₂ TANK VALVE and the H₂ SUPPLY VALVE closed, a small amount of H₂ at high pressure will be present in the regulators and plumbing. As a leak check, observe the H₂ TANK PRESSURE indicator while the remainder of the system is shut down. If the pressure indicator decreases rapidly (greater than 350 PSIG/ hr), there is a significant leak in the H₂ supply system.

D. RECHARGING THE OVA

Never charge the OVA in a hazardous area or environment. Approximately one hour of charging time is required for each hour of operation, although an overnight charge is recommended. The charger can be left on

indefinitely without damaging the batteries.

Recharging the Batteries

1. Plug charger BNC connector into connector on battery cover and insert AC plug into 115V AC wall outlet.
2. Switch on the battery charger switch. The light above the switch should illuminate.
3. Battery charge condition is indicated by the meter on the front panel of the charger. During charging, the meter will deflect to the right and when the battery is fully charged, the pointer will be in line with the "charged" marker above the scale.
4. When the battery is charged, switch off battery charger and unplug it from the Side Pack assembly.

If the battery has been allowed to completely discharge, the above procedures may not be sufficient to recharge the battery. When this happens, the following steps should be taken:

1. Remove the battery from the instrument case.

2. Connect the battery to any variable DC power supply.
3. Apply 50 volts at 1/2 amp maximum.
4. As soon as the meter on the power supply shows that the battery is drawing current, reduce the voltage on the power supply at a slow rate until the meter reads approximately 15 volts. The time required to reach the 15 volt reading will depend on the degree of discharge.
5. Repeat steps 3 and 4 to continue charging.

E. CALIBRATION OF THE OVA

The OVA is capable of detecting nearly all organic compounds. The instrument is factory-calibrated to a methane in air standard, but it can be easily calibrated to any of a variety of compounds for precise analyses.

A GAS SELECT control on the instrument panel is used to set the electronic gain to a particular organic compound. Internal electronic adjustments are provided to calibrate and align the electronic circuits (Figure 2). There are four adjustments on the electronics board, but one adjustment potentiometer, R-38, is used to set the power supply

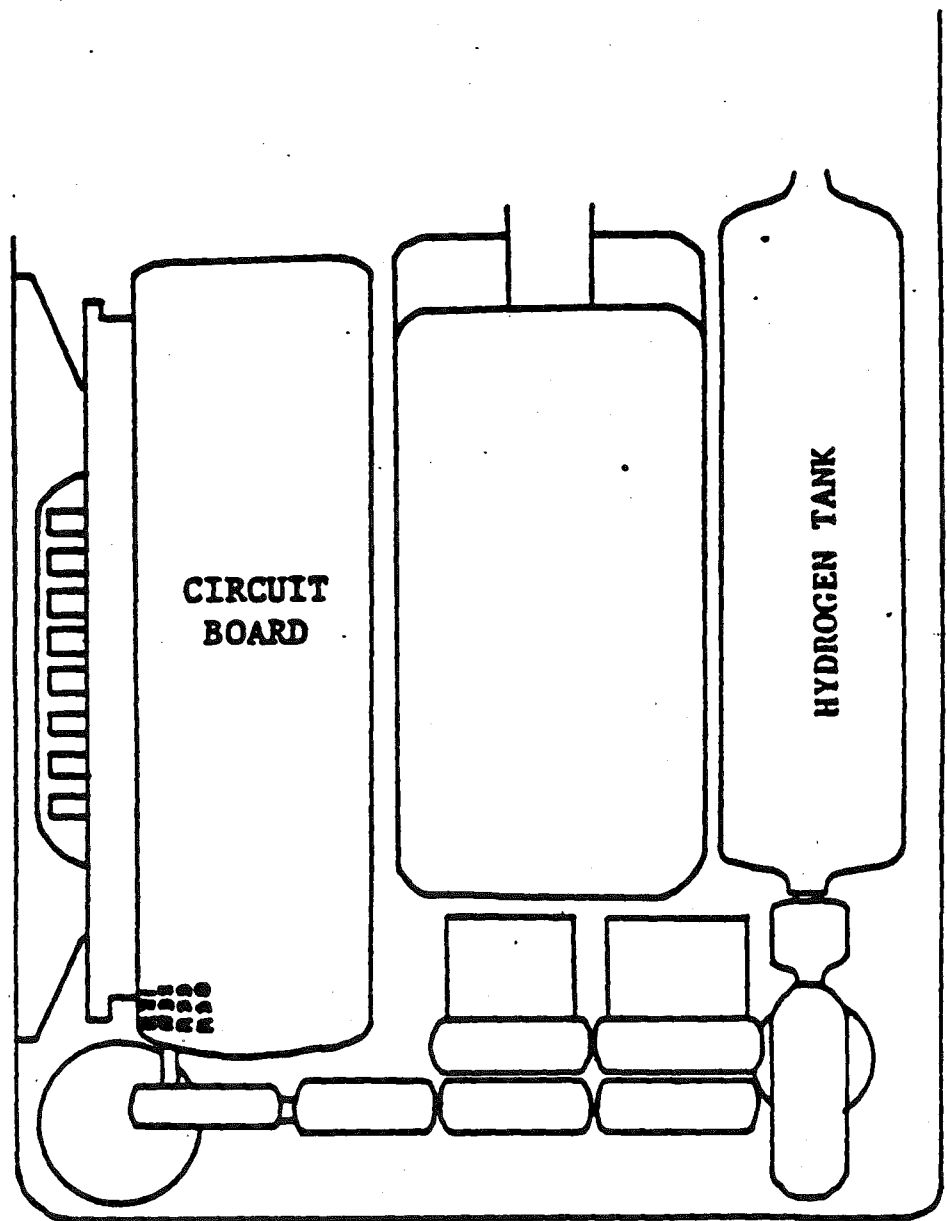


FIGURE 2. LOCATION OF ELECTRONIC ADJUSTMENTS.

voltage and has a one-time factory adjustment. The other three adjustments, R-31, R-32, and R-33, are used for setting the electronic amplifier gain for each of the three calibration ranges. The instrument must be removed from its case to access these adjustments.

To calibrate the OVA to methane, follow the procedures for Gain Adjustment and Bias Adjustment.

Gain Adjustment

1. Turn on instrument as described in Section B. Set CALIBRATE switch to X10 and GAS SELECT control to 300.
2. Use the CALIBRATE ADJUST knob to adjust the meter reading to zero.
3. Introduce a methane sample of a known concentration (near 100 ppm) and adjust trimpot R-32 on the circuit board so that the meter reads the concentration as equivalent to that of the known sample. This sets the instrument gain for methane with the gain adjustment on the panel (GAS SELECT knob) set at a reference of 300.
4. Turn off the H₂ SUPPLY VALVE to put out the flame.

Bias Adjustment

5. Leave the CALIBRATE switch on X10 position and use the CALIBRATE ADJUST knob to adjust the meter reading to 4 ppm.
6. Turn the CALIBRATE switch to X1. Using trimpot R-31 on the circuit board, adjust the meter reading to 4 ppm.
7. Set the CALIBRATE switch to X10 again and use the CALIBRATE ADJUST knob to set meter reading to 40 ppm.
8. Move the CALIBRATE switch to X100 position and use trimpot R-33 on the circuit board to adjust meter to 40 ppm.
9. Set the CALIBRATE switch to X10 position and use the CALIBRATE ADJUST knob to adjust meter to zero.

The unit is now balanced from range to range, calibrated to methane, and ready for use.

Calibration to Various Organic Vapors

Primary calibration of the OVA is accomplished by using a known mixture of a specific organic vapor compound.

To calibrate for a specific gas, turn the instrument on as described in Section B, and use the following procedures:

1. Zero out the ambient background reading.
2. Draw a sample of the calibration gas into the instrument. Calibration gases of known concentrations can be obtained from local laboratories or prepared by injecting a known concentration of compound into a known volume of air.
3. Use the GAS SELECT knob to adjust the meter to correspond to the known concentration of the calibration gas mixture.
4. Read and record the setting on the digital. This is the setting for that particular organic vapor compound.

The instrument is now calibrated for the specific gas mixture. This can be repeated for a large variety of compounds. When a particular compound is to be read, turn the GAS SELECT control to the setting that was recorded for that compound. Calibration on any one range automatically calibrates the other two ranges.

Relative response data can be used to estimate concentrations of various vapors. With the instrument calibrated to methane, obtain the concentration reading for a calibration sample of the test vapor. The relative response, in percent, for that test vapor would then be:

$$\frac{\text{concentration read}}{\text{concentration of calibrated sample}} \times 100.$$

F. APPLICATIONS

Sample Screening

Priority Pollutant Analyses at hazardous waste sites can run \$1,500 a sample. To initially screen samples before analysis to determine if any contaminant is found can be a very cost-effective method. In order to do this, duplicate samples should be collected in 40 ml VOA jars with Teflon-lined caps. Be sure to leave head space in each of the sample jars, for it is actually the head space that you will be analyzing.

Standards can be purchased or prepared specifically for the concentration and identity of the compound or compounds in question. The standard is injected with a gas-tight syringe as described in Part B and retention time and peak height are measured from the standard. Be sure to purge

the gas-tight syringe before injecting a sample to prevent cross-contamination.

A known volume (100-1,000 ul) of head space is then injected into the column. Retention times and peak heights for the sample are then compared back to the standard to verify if the compound exists, and, if so, an approximate concentration can be determined. If the sample indicates a positive presence for a specific compound, then the duplicate sample could be sent to an analytical laboratory for quantitation.

General Surveying

The OVA instrument is a very good general survey instrument and is usually used in conjunction with the photo-ionization detector (PID) to verify accuracy of the general readings. The instrument can be used to detect methane whereby the PID is not sensitive to methane. Also, vapor levels can be accessed to diagnose hazards that exist on site and to determine proper levels of personnel protection.

Fugitive Air Emissions

Monitoring of fugitive air emissions at hazardous waste sites can be accomplished by placing one OVA upwind and one downwind of a site.

The instruments are placed in general survey modes and hooked to a strip chart recorder to monitor daily vapor emissions. If properly charged and filled with hydrogen, the instruments will operate on a 8-10 hour basis unattended.

G. TROUBLESHOOTING THE OVA

Table G-1 presents a summary of recommended field troubleshooting procedures when using the instrument in the survey mode. If necessary, the instrument can be easily removed from the case by unlocking the four one-quarter turn fasteners on the panel face and removing the refill cap and exhaust port. The battery pack is removed by taking out the four screws on the panel and disconnecting the power connector at the battery pack.

Table G-2 presents recommended field troubleshooting procedures which are peculiar to the GC system. These are in addition to what is presented in Table G-1.

TABLE VI

TROUBLESHOOTING IN SAMVEY MODE

TROUBLE

TROUBLE SHOOTING PROCEDURE

REMEDY

1. Low sample flow rate on flow indicator. Maximal 2 units on flow gauge. (See also 6 below.)

a) Check primary filter in sidepack and particle filters in the pickup assembly.

Replace or clean filter if clogged. The filter is located behind the sample inlet connector on the Side Pack Assembly and is removed by using a thin wall socket to unscrew the Fitting Assembly. The filter cap, "O" ring, and loading spring will come out and the filter cap can then be cleared by blowing it out or washing it in a solvent. If a solvent is used, all solvent should be removed by blowing out or heating the filter. Reassemble in reverse order.

b) Determine assembly containing restriction by process of elimination, i.e., remove probe, remove Readout Assembly, remove primary filter, etc.

Investigate the assembly containing this restriction determine cause of blockage. Clean or replace as required.

c) If the restriction is in the Side Pack Assembly, further isolate by disconnecting the sample flow tubing at various points, i.e., pump output, chamber input, etc.
Note: The inherent restrictions due to length of sample line, flame arrestors, etc., must be taken into account when troubleshooting.

If restriction is in the detector chamber, remove and clean or replace porous metal flame arrestors. If pump is found to be the problem, remove and clean or replace.

2. H₂ flame will not light. (See also 6 below).

a) Check sample flow rate (see 1 above).

If sample flow rate is low, follow procedure 1 above.

b) Check igniter by removing the chamber exhaust port and observing the flow when the IGNITE Button is depressed.

If igniter does not light up, replace the plug. If igniter still does not light, check the battery and wiring.

c) Check for rated H₂ Supply Pressure. (Listed on calibration plate on pump bracket.)

If low, remove battery pack and adjust to proper level by turning the allen wrench adjustment on the low pressure regulator cap.

d) Check H₂ flow rate by observing the PSI decrease in pressure on the H₂ Tank Pressure gauge. The flow rate should be about 130 PSI decrease in pressure per hour. (Approximately 12 cc/min. at detector.)
On instruments with EZ Option, disconnect column and measure H₂ flow rate with a bubble meter.

The usual cause for H₂ flow restriction is blocked or partially blocked capillary tube. If flow rate is marginally low, attempt to compensate by increasing the H₂ Supply Pressure by one-half or one PSI. If flow rate cannot be compensated for, replace capillary tubing.

TABLE G1 (Continued)

TABLE

TRUBLE SHOOTING PROCEDURE

REMEDY

	<p>e) Check all H₂ plumbing joints for leaks using soap bubble solution. Also, shut off all valves and note pressure decay on H₂ tank gauge. It should be less than 350 PSIG per hour.</p> <p>f) Check to see if H₂ supply system is frozen up by taking unit into a warm area.</p> <p>g) Remove exhaust port and check for contamination.</p> <p>h) Check spacing between collecting electrode and burner tip. Spacing should be 0.1 to 0.15 inches.</p>	<p>Repair leaking joint.</p> <p>If there is moisture in the H₂ supply system and the unit must be operated in subfreezing temperatures, purge the H₂ system with dry H₂ and ensure the H₂ gas used is dry.</p> <p>If the chamber is dirty, clean with ethyl alcohol and dry by running pump for approximately 15 minutes. If H₂ fuel jet is misaligned, ensure the porous metal flame arrester is properly seated.</p> <p>Adjust by screwing Mixer/Burner Assembly in or out. This spacing problem should only occur after reassembling a Mixer/Burner Assembly to a Preamp Assembly.</p>
3. H ₂ flame lights but will not stay lighted	a) Follow procedures 2(a), (c), (d), (e), (g), and (h) above. Also refer to 5 below.	
4. Flame-out alarm will not go on when H ₂ flame is out.	a) Check instrument calibration setting and GAS SELECT control setting. Refer to Section B-Turn On Procedure.	Readjust as required to proper setting. Note that on linear O ₂ As the flame-out alarm is actuated when the meter reading goes below zero. On logarithmic O ₂ As, the alarm is actuated when the signal level goes below 1 ppm oxygen or equivalent.

TABLE G1 (Continued)

TROUBLE	TROUBLE SHOOTING PROCEDURE	REMEDY
	<p>b) Remove exhaust port and check for leakage in current path in chamber (probably moisture or dirt in chamber).</p> <p>c) If above procedures do not resolve the problem, the probable cause is a malfunction in the pump or power board assemblies.</p> <p>d) Check that volume control knob is turned up.</p>	<p>Clean contamination and/or moisture from the chamber using a scrub and alcohol, then dry chamber by running pump for approximately 15 minutes.</p> <p>Return pump chamber or power board assembly to the factory for repair.</p> <p>Adjust for desired volume.</p>
5. False flame-out alarm. (Applies to linear OVAs.)	a) Flame-out alarm is actuated on linear instruments when signal goes below electronic zero (even though flame is still on). This can be due to inaccurate initial setting, drift or a decrease in ambient concentration. Verify if this is the problem by zeroing meter with flame out and re-igniting. (See Section 8-Turn On Procedure.)	When using the XI range, adjust meter to 1 ppm rather than zero. Be sure instrument has been zeroed to zeroed "lowest expected ambient background level."
6. Slow response time, i.e., time to obtain response after sample is applied to input.	<p>a) Check to ensure that probe is firmly seated on the rubber seal in the readout assembly.</p> <p>b) Check sample flow rate per procedure 1 above.</p>	<p>Reset by holding the probe firmly against the rubber seat and then lock in position with the knurled locking nut.</p> <p>See 1 above.</p>

TABLE G1 (Continued)

TROUBLE	TROUBLE SHOOTING PROCEDURE	REMEDY
7. Slow recovery time, i.e., too long a time for the reading to get back to ambient after exposure to a high concentration of organic vapor.	<p>a) This problem is normally caused by contamination in the sample input line, requiring pumping for a long period to get the system clean of vapors again. Charcoal in the lines would be the worst type of contamination. Isolate through the process of elimination. (See 1(b)).</p> <p>b) Check flame chamber for contamination.</p>	<p>Clean or replace contaminated sample line or assembly as required.</p> <p>Clean as required.</p>
8. Ambient background reading in clean environment is too high. The acceptable background reading is 1 to 1 1/2 ppm of methane which is present in the normal air environment. In addition, there will normally be 2 to 4 ppm of equivalent methane background caused by acceptable levels of contamination in the hydrogen fuel and/or in the hydrogen fuel handling system. A total of 3 to 5 ppm in clean air, therefore, is an acceptable background reading.	<p>a) An ambient background reading can be caused by hydrocarbons in the H₂ fuel supply system. Place finger over sample probe tube restricting sample flow and if meter indication does not go down significantly, the contamination is probably in the H₂ fuel.</p> <p>b) An ambient background reading can be caused by a residue of sample building up on the face of the sample inlet filter. If the test in 8(a) above produces a large drop in the reading, this is usually the cause.</p> <p>c) An ambient background reading can also be caused by hydrocarbon contamination in the sample input system. The most likely cause would be a contaminant absorbed or condensed in the sample line.</p> <p>NOTE: It should be emphasized that running the instrument tends to keep down the build-up of background vapors. Therefore, run the unit whenever possible and store it with the carrying case open in clean air.</p>	<p>Use a higher grade of hydrocarbon-free hydrogen. Check for contaminated fittings on filling hose assembly.</p> <p>Remove the exhaust port (it is not necessary to remove instrument from case), use small wire brush from the tool kit or a knife blade and lightly scrub the surface of sample inlet filter.</p> <p>Clean and/or replace the sample input lines. Normally, the lines will clear up with sufficient running.</p>

TABLE G1 (Continued)

TROUBLE	TROUBLE SHOOTING PROCEDURE	REPAIR
9. Pump will not run.	a) Check 1 AMP Slo-Blo fuse on the battery pack cover. NOTE: Certified OVAs do not have fuses.	Replace fuse. IMPORTANT: Note that fuse is a Slo-Blo type. If fuse continues to blow when igniter switch is closed, check igniter for short circuit. If igniter is not the problem, there is a short in the wiring or pump motor. Return OVA to factory or authorized repair facility.
10. No power to electronics but pump runs.	a) Check 1/4 AMP fuse on the battery pack cover. NOTE: Certified OVAs do not have fuses.	Replace fuse. If fuse continues to blow, there is a short in the electronics assembly. Return OVA to factory or authorized repair facility.
11. No power for pump or electronics.	a) Place battery on charger and see if power is then available. Recharge in a non-hazardous area only.	If power is available, battery pack is dead or open. Recharge battery pack. If still defective, replace battery pack. Refer to Section 8.

TABLE G2

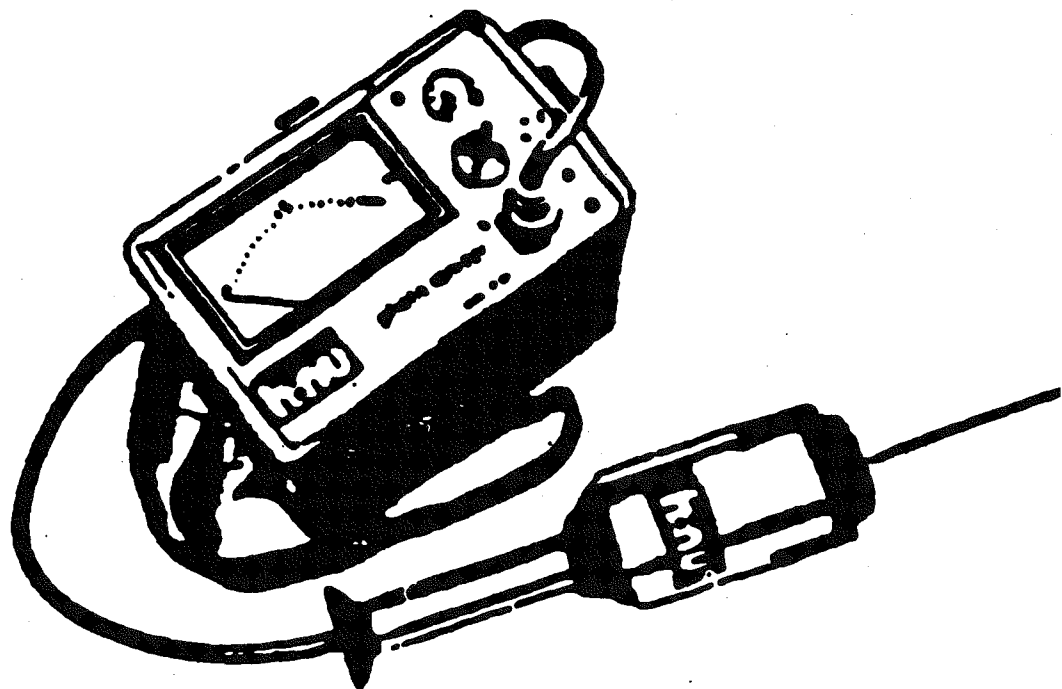
TROUBLESHOOTING IN GC MODE

TROUBLE	TROUBLE SHOOTING PROCEDURE	REMEDY
1. Low sample flow rate on flow indicator.	a) Check Teflon tubing on valve assembly for kinks, etc. b) Check flow rate with valve in down position.	Straighten or replace Teflon tubing. Check for over restriction of charcoal filter.
2. H ₂ flame will not light.	a) Check column connections on top of unit to make sure they are tight. b) Check column for sharp bends or kinks. (Hydrogen flows through this column at all times and a sharp bend will compact packing too tightly for proper hydrogen flow.) c) Check charcoal filter fittings to make sure they are tight. d) Check H ₂ flow rate from the column. e) Check that the Inject and Backflush Valves are both completely in or out. A partially activated valve will block the H ₂ and air flow paths. f) If a new column was installed prior to problem identification, check for proper hydrogen flow rate through the column (should be approximately 12 cc/minute).	Tighten fittings. Replace column. Tighten fittings. Adjust hydrogen pressure to obtain 12 cc/min flow rate. Ensure both valves are either completely in or out. Increase hydrogen pressure to obtain proper hydrogen flow rate or if column is excessively restrictive, replace or repace the column.
3. Ambient background reading in clean environment is too high.	a) Check for contamination in charcoal filter assembly. This can be detected if ambient reading increases when going into the chromatographic mode. b) Check for contamination in column by installing a new column or a blank column (tubing only). If this reduces background reading, column is contaminated. c) Check for contamination in column valve	Replace activated charcoal in charcoal filter assembly. Replace or clean column by baking column at 300°C for 3 or 4 hours in a drying oven while passing nitrogen through the column; or clean by placing hot, wet towels on the column while it is still on the OVA. Remove valve stems and wipe with clean lint-free cloth. Heat valve assembly during operation to vaporize and remove contaminants.

TABLE F2 (Continued)

TROUBLE	TROUBLE SHOOTING PROCEDURE	REMEDY
4. Flow-out when operating either valve.	<p>a) Ensure valves are being operated with a quick, positive motion.</p> <p>b) Either H₂ or air may be leaking around one or more of the valve quad rings. Assess by tests and "O" ring inspection.</p> <p>c) Damaged or worn quad rings causing leak.</p>	<p>Operate valve with a positive motion.</p> <p>Remove stems and lightly coat with silicone grease, only on contact surface of the "O" ring. Wipe off excess (do not remove quad rings).</p> <p>Replace quad rings and grease as above.</p>
5. Excessive peak tailing.	<p>a) Charge or clean GC column and see if problem disappears.</p> <p>b) Inspect GC valves for excessive silicone grease or contamination.</p>	<p>Ensure columns are clean prior to use. Refer to #1b (a) for cleaning instructions. If one of a same type of column tails worse than others, replace the column or discard.</p> <p>Excessive lubricant or foreign matter in the valve assembly can cause excessive tailing. Clean valve assemblies and lightly relubricate as required. Lubricant should be put only on the outside contact surface of the "O" ring. Do not get grease into "O" ring.</p>

**FIELD MANUAL FOR THE
OPERATION, CALIBRATION
AND TROUBLESHOOTING OF THE
HNC PHOTOIONIZER**



WESTON INSTRUMENTS, INC.
WESTON

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A.) INTRODUCTION TO THE HNU

The HNU is a portable trace gas analyzer that can be used to measure a wide variety of organic vapors including chlorinated hydrocarbons, heterocyclics and aromatics, aldehydes and ketones, as well as several inorganic gases including hydrogen sulfide and ammonia.

The HNU photoionizer employs the principal of photoionization for detection. Photoionization is initiated by the absorption of a photon of ultraviolet radiation energetic enough to ionize a molecule and produce an instrument response only if the ionization potential (IP) is equal to or slightly less than the ionizing energy supplied by the instrument's UV lamp (9.5 eV, 10.2 eV, 11.7 eV). Species that have a very high IP will display a poor instrument response or none at all. Employing the 11.7 eV lamp will ensure the total range of detectable species, but there will still be a number of undetectable sample components, such as cyanide or methane. So, whenever possible, it is recommended that the 11.7 eV probe be used in cases involving unknown species.

The 11.7 eV lamp is identified by the inscription "11.7 eV" near the

lamp number on the glass envelope. A comparison of response to selected species of compounds utilizing the 9.5 eV, 10.2 eV and 11.7 eV lamps are listed in Table 1. The relative sensitivity of the 11.7 eV lamp is about one-tenth that of the 10.2 eV. The 11.7 eV lamp provides a more universal response than the 10.2 lamp which makes the 11.7 eV lamp more practical to our type of needs at Weston.

CAUTION: The HNU instrument is not intrinsically safe. Its use in a probable explosive environment should be attempted after the area in question has been metered by a explosimeter and deemed safe for the HNU instrument operation.

TABLE 1

SELECTED LIST OF SPECIES DETECTED

Class species	Photoionization Response		
	9.5eV lamp	10.2 eV lamp	11.7 eV lamp
Paraffins and unsaturated hydrocarbons			
methane	NR	NR	NR
ethylene	NR	L	H
acetylene	NR	NR	H
1-butene	H	H	H
hexane	NR	L	H
Chlorinated hydrocarbons			
methyl chloride	NR	NR	H
carbon tetrachloride	NR	NR	H
chloroform	NR	NR	H
dichloroethane	NR	NR	H
vinylidene chloride	L	H	H
trichloroethylene	H	H	H
Heterocyclics & aromatics			
phenol	H	H	H
pyridine	H	H	H
benzene	H	H	H
toluene	H	H	H
xylene	H	H	H
styrene	H	H	H
aniline	H	H	H
chlorobenzene	H	H	H
nitrobenzene	NR	L	H
Nitrogen compounds			
formamide	NR	H	H
ammonia	NR	L	H

TABLE 1 (Continued)

Class species	Photoionization Response		
	9.5eV lamp	10.2 eV lamp	11.7 eV lamp

Nitrogen compounds (Continued)

hydrazine	H	H	H
methyl amine	H	H	H
acetonitrile	NR	NR	NR
acrylonitrile	NR	NR	H

NR = No response.
H = High response.
L = Low response.

B.) OPERATION

- 1.) Before attaching the probe, check the function switch on the control panel to make sure it is in the "OFF" position. Figure 1.
- 2.) Carefully match the alignment key in the probe connector to the 12 pin connector on the control panel, and then twist the probe connector until a distinct snap and lock is felt.

- 3.) Turn the function switch to the battery check position. The needle on the meter should read within or above the green battery arc on the scale plate.

If the needle is in the lower portion of the arc, recharge before use. If the LED comes on, recharge before use. (See Section D. Recharging the HNU.)

- 4.) Turn the function switch to "On." In this position, the UV light source should be on. If looking into the end of the probe reveals a purple glow, the UV light source is working.

- 5.) Set the span to the desired gain.

- 6.) Zero the instrument by turning the function switch to the stand-by position and rotate the zero potentiometer knob. Clockwise produces an up-scale deflection and counterclockwise yields a downscale deflection:

NOTE: If the span adjustment setting is changed after the zero is set, the zero should be rechecked and adjusted, if necessary. (Stand-by position)

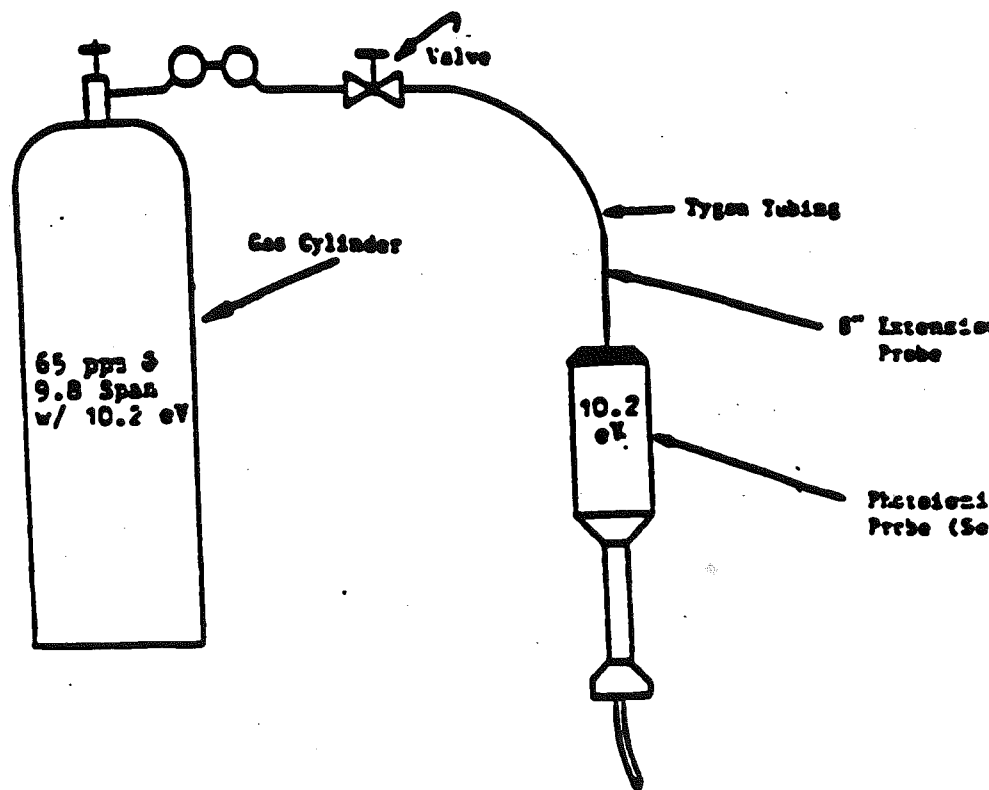


FIGURE 2
Recommended Calibration Procedure

The instrument is supplied calibrated to read directly in ppm (0-20, 0-200, 0-2000) of benzene with the span position set at 9.8. For additional sensitivity, the span potentiometer is turned counterclockwise (smaller numbers) to increase the gain. Changing the gain changes instrument sensitivity and specificity (if changed from 9.8, it will no longer be direct reading for benzene). By changing the span setting from 10.0 to 1.0, the sensitivity is increased approximately ten-fold. The 0-20, 0-200 and 0-2000 scales become 0-2, 0-20 and 0-200, respectively.

The span control can be utilized to calibrate nearly any compound, measured by photoionization, to be direct reading on the 0-20 ppm range. For example, gain settings of 4.5 or 8.9, respectively, will provide direct reading capability (0-20, 0-200 ppm) for vinyl chloride and trichloroethylene, respectively. Table 2 is a listing of approximate gain setting values for some common compounds. Note that these settings are approximate until the meter is calibrated against the specific compound.

TABLE 2

RELATIVE PHOTOIONIZATION SENSITIVITIES
FOR VARIOUS GASES

<u>Grouping</u>	<u>Span/Gain Setting</u>	<u>Examples</u>
Aromatic	9.8	Benzene, Toluene, Styrene
Aliphatic Amine	9.8	Diethylamine
Chlorinated		
Unsaturated	5-9	Vinyl Chloride, Vinylidene Chloride, Tri- chloroethylene
Carbonyl	5-7	MEK, MIBK, Acetone, Cyclohexene
Unsaturated	3-5	Acrolein, Propylene, Cyclohexene, Allyl Alcohol
Sulfide	3-5	Hydrogen Sul- fide, Methyl Mercaptan
Paraffin (C ₅ -C ₇)	1-3	Pentane, Heptane
Ammonia	0.3	--
Paraffin (C ₁ -C ₄)	0	Ethane, Propane, Butane

- 7.) The instrument is now ready for calibration or measurement by switching the function switch to the proper measurement range, i.e., 0-20, 0-200, or 0-2000.

C.) CALIBRATION

The recommended and most accurate procedure for calibration of the HNU instrument is utilizing a pressurized gas cylinder containing a known ppm value at a specified span setting attached to a designated probe. The following procedure refers to Figure 2.

- 1.) Follow steps 1-7 in OPERATION section (above).
- 2.) Attach the tygon tubing to the 8" extension probe of the photoionization probe.
- 3.) Crack the valve of the pressurized cylinder until a slight flow of gas is being released from the cylinder.

The instrument should read +10% of the gas value; if not, one of two things can be done:

- a. Change span to get the gas value. NOTE: If span is changed more than +10%, proceed to b.

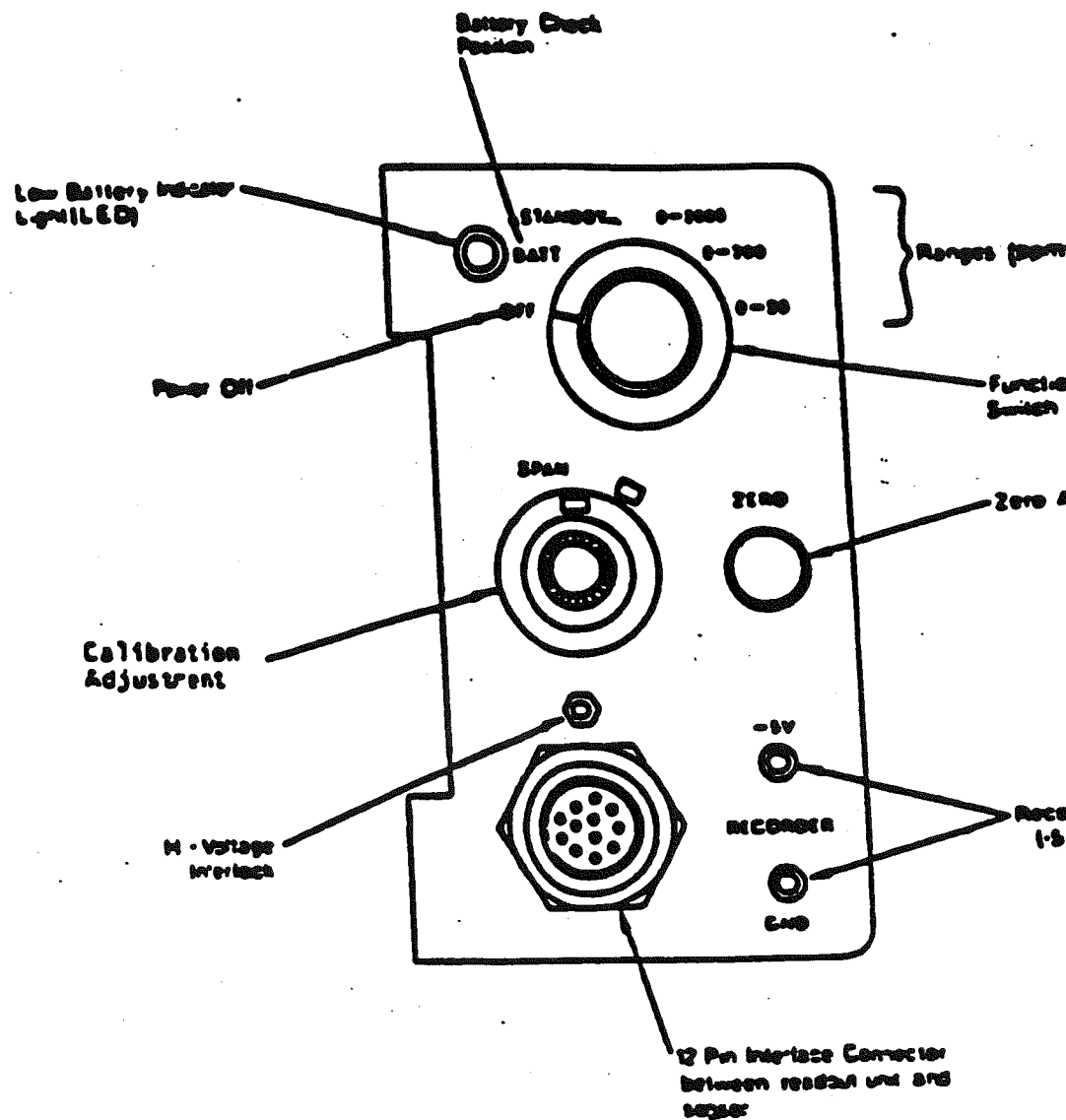


FIGURE 1
Control Panel Functions

- b. Clean lamp and IP chamber. A dirty lamp will yield low readings, and a dirty chamber will yield high readings.

NOTE: If the instrument span setting is changed, the instrument should be turned back to the stand-by position and rezeroed, if necessary.

If using the 11.7 eV probe and the gas calibration cylinder showing a ppm value of 9.8 span with 10.2 eV probe, all steps above will be necessary. The final span setting using the 11.7 eV probe should be approximately the same value as indicated for the specific probe in Appendix 2.

The HNU instrument is now ready for field measurements.

D.) RECHARGING THE HNU

To ensure no damage to the HNU instrument and to extend the life of the battery, the following steps should be followed when recharging the HNU.

- 1.) Place the miniphone plug into the jack on the left side of the read-out unit.

- 2.) Plug the charger into a 120 vac outlet.
- 3.) Let stand overnight or for at least 14 hours.

NOTE: Overcharging is not a major problem with the HNU as it has a built-in solid-state battery protection circuit; also, when the battery voltage drops below approximately 11 volts, this circuit will automatically turn off power to the instrument. This prevents deep discharging of the battery.

It is, however, recommended that if the battery check shows ample power available, not to charge the unit.

- 4.) When disconnecting the charger, remove the charger from the 120 vac before removing the miniphone plug.

The instrument can be operated during the recharging cycle. This will only lengthen the time required to completely recharge the instrument battery.

E.) FALSE READINGS

Incorrect values may be detected by the HNU, outside of mechanical failures within the unit. Some of the field situations which may be encountered are as follows:

- 1.) High wind
- 2.) High humidity (>95%)
- 3.) Probe too far from source
- 4.) High electrical areas
- 5.) Temperatures above 105°F or below 32°F.

High wind and high humidity are two variables beyond control of the instrument operator. The probe being too far from the source is self-explanatory for correction. When working around high electrical areas, the following steps may be utilized to obtain relevant measurements.

- 1.) Zero the instrument in an electrically quiet area in the stand-by position.
- 2.) Move the instrument to the area in question. If AC pick-up is going to be a problem, the meter (in the stand-by position) will indicate the magnitude of error.
- 3.) Subtract this difference, Step 2, from the indicated value to obtain the actual value.

The HNU should not be used in temperatures greater than 105°F. In temperatures less than 32°F, the unit should function properly as long as the probe extension and probe inlet are wiped dry after use. The probe extension should be wiped dry because when moving the unit from a warm area to a cold area and back to a warm area again, condensation will develop inside the extension probe causing erratic values. If moisture enters into the lamp area of the probe, the following steps should be taken to free the unit of moisture or dust particles. Figure 3.

- 1.) Turn the function switch to the off position.
- 2.) Disconnect the probe from read-out unit.
- 3.) Remove the exhaust screw found near the base of the probe.
- 4.) Grasp the end cap in one hand and the probe shell in the other; gently pull to separate the end cap and lamp housing from shell.
- 5.) Loosen the screws on the top of the end cap and separate the end cap and ion chamber from the lamp and lamp housing.

- 6.) Turn the end cap over into your hand and tap on the top of it; the ion chamber should fall out into your hand.
- 7.) Place one hand over the top of the lamp housing and tilt slightly, the light source will slide out into your hand.
- 8.) Wipe dry all parts with a soft dry cloth, except for lamp and lamp window.

CAUTION: If the window in lamp of the 11.7 eV lamp is dirty and needs to be cleaned, do not clean with water or any organic solvent miscible with water such as acetone or methanol. The window should be cleaned with a soft tissue dipped in an organic (nonwater miscible) solvent or freon. The cleaning compound for the 10.2 eV lamp should not be used under any circumstances on the 11.7 eV lamp.

F.) TROUBLESHOOTING

Some of the basic problems which may occur and probable causes and solutions are as follows:

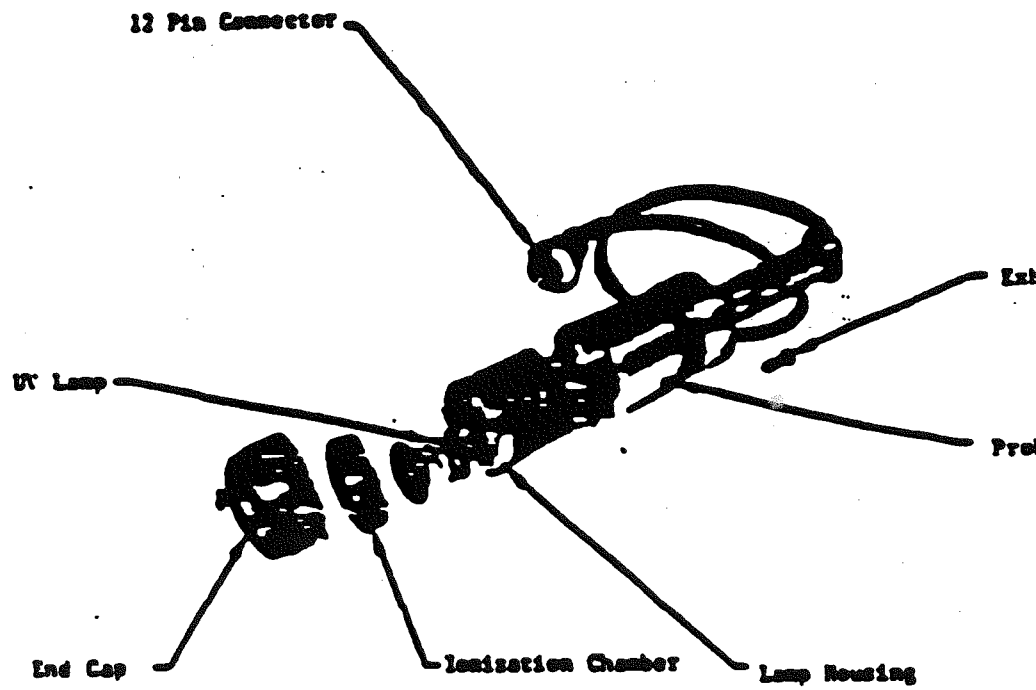


FIGURE 3
Component Parts of Probe

1. No meter response in any switch position (including BATT CHK)

A. Broken meter movement

(1) Tip instrument rapidly from side to side. Meter needle should move freely and return to zero.

B. Electrical connection to meter is broken

C. Battery is completely dead

(1) Disconnect battery and check voltage with a volt-ohm meter.

D. Check 2 amp fuse

E. If none of the above solves the problem, consult the factory.

2. Meter responds in BATT CHK position, but reads zero or near zero for all others

A. Power supply defective

(1) Check power supply voltages. If any voltage is out of specification, consult the factory.

B. Input transistor or amplifier has failed

- (1) Rotate zero control; meter should deflect up/down as control is turned.**
- (2) Open probe. Both transistors should be fully seated in sockets.**

C. Input signal connection broken in probe or read-out

- (1) Check input connector on printed circuit board. Should be firmly pressed down.**
- (2) Check components on back side of printed circuit board. All connections should be solid, and no wires should touch any other object.**
- (3) Check all wires in read-out for solid connections.**

3. Instrument responds correctly in BATT CHK, and STBY, but not in measure mode.

A. Check to see that light source is on.

(1) Check high voltage power supply.

(2) Open end of probe; remove lamp and check high voltage on lamp contact ring.

(3) If high voltage is present at all above points, light source has most likely failed. Consult the factory.

4. Instrument responds correctly in all positions but signal is lower than expected.

A. Check span setting for correct value.

B. Clean window of light source.

C. Check power supply 180 V output.

D. Check for proper fan operation. Check fan voltage.

E. Rotate span setting. Response should change if span pot is working properly.

5. Instrument responds in all switch positions, but is noisy (erratic meter movement).
 - A. Open circuit in feedback circuit. Consult the factory.
 - B. Open circuit in cable shield or probe shield. Consult the factory.
6. Instrument response is slow and/or irreproducible.
 - A. Fan operating improperly. Check fan voltage.
 - B. Check calibration and operation. See Sections B and C.
7. Low battery indicator.
 - A. Indicator comes on if battery charge is low.
 - B. Indicator also comes on if ionization voltage is too high.

